



UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Faculty of Natural and Agricultural Sciences

Fakulteit Natuur- en Landbouwetenskappe
Lefapha la Disaense tša Tlhago le Temo

www.up.ac.za/nas



Note: The minimum admission requirements reflected in this brochure are subject to changes in regulations relating to COVID-19. Amendments will reflect in the digital version of this brochure, which can be downloaded from www.up.ac.za/programmes > Undergraduate > Faculty brochures.

2023

UNDERGRADUATE
FACULTY BROCHURE

Make today matter

Message from the Dean

I'm writing this message at the end of 2021 in preparation for the 2022 recruitment and enrolment campaign for the 2023 academic year. I don't know what the pandemic's trajectory will look like in 2023, but I am sure that the widespread roll-out of vaccines will dramatically improve our chances of a more stable academic year in 2023, with safe options for more on-campus activities.

Prof Barend Erasmus
Dean: Faculty of Natural and Agricultural Sciences



The pandemic has allowed us to re-imagine what a university should look like and how it should conduct its core business of research, teaching and learning, and community engagement. We have moved away from emergency online teaching, and we are transitioning towards a hybrid learning model, where high quality, purposefully-designed on-campus activities will complement a sophisticated online learning environment for a better education. It will provide you with more flexibility to complete your education without sacrificing the quality that UP, and the Faculty of Natural and Agricultural Sciences (NAS), is well-known for.

Hybrid learning is just one of the many ways in which NAS leads education on the continent. The pandemic has taught us the value of science for society. The diversity of our programmes, our industry connections, the quality of our research and our deep and meaningful community engagement projects all contribute to your education to launch you on a pathway to a fulfilling career that will have an impact on the world.

NAS is a faculty known for its diversity in respect of people and disciplines and how we view the world. This diversity, which helps us look at old problems from new perspectives, plays a crucial role in ensuring our excellence in teaching and research. It also provides an ideal template for cross-cutting research, where diverse disciplines combine forces to solve the societal problems of the day.

Our excellence in teaching and research is also recognised by our large number of partners outside of academia. We work together with several companies, non-profit organisations, industry bodies and government departments, which means that the qualification you receive from NAS gives you a unique edge for employment. The excellent research and teaching you are exposed to during your training, combined with valuable real-world experience, will make you a sought-after candidate for employment.

As a student in NAS, you will be mentored by leading scientists and trained in the use of state-of-the-art equipment. Here you will be at the forefront of scientific research, and you will be inspired to think innovatively. In NAS, we have a deep appreciation of humanity's connection to the living world, and we explore new opportunities for investigating how it shapes our livelihoods.

We are known for our expertise in forestry and agriculture, the life sciences and mathematical and statistical sciences—all supported by genuine scholarship and excellence in the basic sciences. We offer some unique degrees (in Meteorology and Nutrition, for example), and even though there may be similar offerings elsewhere, we have attractive double major options (and even a unique triple major in Human Physiology, Genetics and Psychology). Food- and water security in Africa, which are two of our many focus areas, can be approached from many angles: climate change, biotechnology, crop development, breeding, data science, agricultural economics, insurance risk, consumer behaviour, indigenous crops, pests and diseases, carbon cycling and environmental change, to name but a few.

I want to welcome you to NAS and look forward to joining you on an exciting journey.

Email nas@up.ac.za



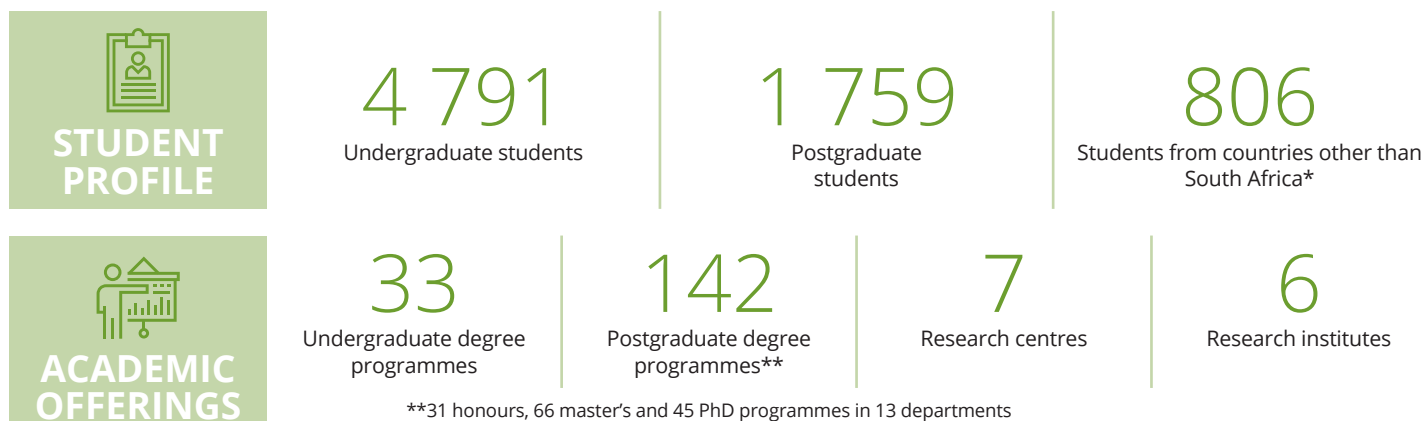
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NAS at a glance

The Faculty of Natural and Agricultural Sciences is the most diverse faculty of its kind in Africa.

All degree programmes are designed to develop problem-solving individuals who can easily adapt to changing circumstances and take the lead in their chosen fields of specialisation. Our world-class qualifications provide access to numerous career opportunities for dynamic and creative people. Some of the Faculty's degree programmes are unique to the University of Pretoria, while others are also offered at other institutions.



UNIQUE DEGREES



BSc (Meteorology) is the only degree of its kind offered in sub-Saharan Africa.



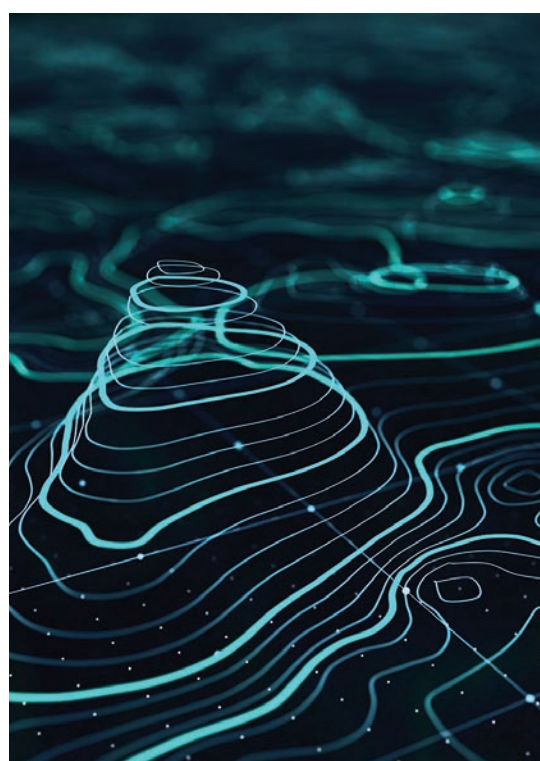
On the Mamelodi Campus, BSc – Extended Programmes are offered to applicants who do not comply with the minimum admission requirements.



BSc (Culinary Science) – the only degree of its kind in Africa

The Faculty presents undergraduate degrees in the following fields:

Biological Sciences	Agricultural and Food Sciences
BSc in: <ul style="list-style-type: none"> Biochemistry Biotechnology Ecology Entomology Genetics Human genetics Human physiology Human physiology, genetics and psychology Medical sciences Microbiology Plant science Zoology <p>BSc (Biological Sciences) is a generic first-year programme in Biological Sciences</p>	BSc in: <ul style="list-style-type: none"> Culinary science Food science Nutrition BScAgric in: <ul style="list-style-type: none"> Agricultural economics and agribusiness management Animal science Applied plant and soil sciences Plant pathology Consumer Science (BConSci) in: <ul style="list-style-type: none"> Clothing retail management Food retail management Hospitality management
Physical Sciences	Mathematical Sciences
BSc in: <ul style="list-style-type: none"> Chemistry Engineering and environmental geology Geography and environmental sciences *** Geoinformatics Geology Meteorology Physics <p>*** This programme replaced the BSc (Geography) and the BSc (Environmental Sciences) programmes from 2021</p>	BSc in: <ul style="list-style-type: none"> Actuarial and financial mathematics Applied mathematics Mathematical statistics Mathematics
BSc – Extended programmes (18 months)	
Subject fields in the BSc – Extended programmes <ul style="list-style-type: none"> Biological and agricultural sciences Physical sciences Mathematical sciences 	



Undergraduate programmes

Important information for all prospective students for 2023

- The admission requirements and general information in this brochure apply to students who apply for admission to the University of Pretoria with a National Senior Certificate (NSC) and Independent Examination Board (IEB) qualifications.
- Applicants with qualifications other than the abovementioned should refer to:
 - **Brochure:** *Undergraduate Programme Information 2023: Qualifications other than the NSC and IEB*, available at www.up.ac.za/programmes > Undergraduate > Admission information.
 - **Brochure:** *Newcomers Guide 2022*, available at www.up.ac.za/programmes > Undergraduate > Admission information.
 - **Website:** www.up.ac.za/international-cooperation-division.
- **School of Tomorrow (SOT) and Accelerated Christian Education (ACE):** The University of Pretoria no longer accepts qualifications awarded by these institutions.
- **General Education Development (GED):** South African GED graduates who graduated up to 2019 may be considered for admission provided they qualify for an exemption certificate issued by USAf and comply with university admission requirements, as well as faculty subject requirements. South African GED graduates who graduated after 2019 cannot be considered for admission to UP as the diploma is not accredited by USAf and will not be considered for exemption. Applicants from the USA who completed the GED may apply for a Foreign Conditional Exemption Certificate issued by USAf accompanied by their SAT/TOEFL/IELTS results.
- **National Certificate (Vocational) (NCV) Level 4:** The University of Pretoria may consider NCV candidates, provided they meet the exemption for bachelor's status criteria and the programme requirements.

Important faculty-specific information on undergraduate programmes for 2023

The closing date for all selection programmes is **30 June 2022**. The University of Pretoria has decided not to set a specific closing date for applications to non-selection programmes for 2023. Applications will close when the available study spaces are filled (**close on availability of space**). Once the available number of study places for a specific programme are filled, no further applications for that particular programme will be considered. All applicants are therefore strongly advised and encouraged to submit their applications as soon as possible after 1 April 2022 and to check the application site (UP Student Portal) regularly.

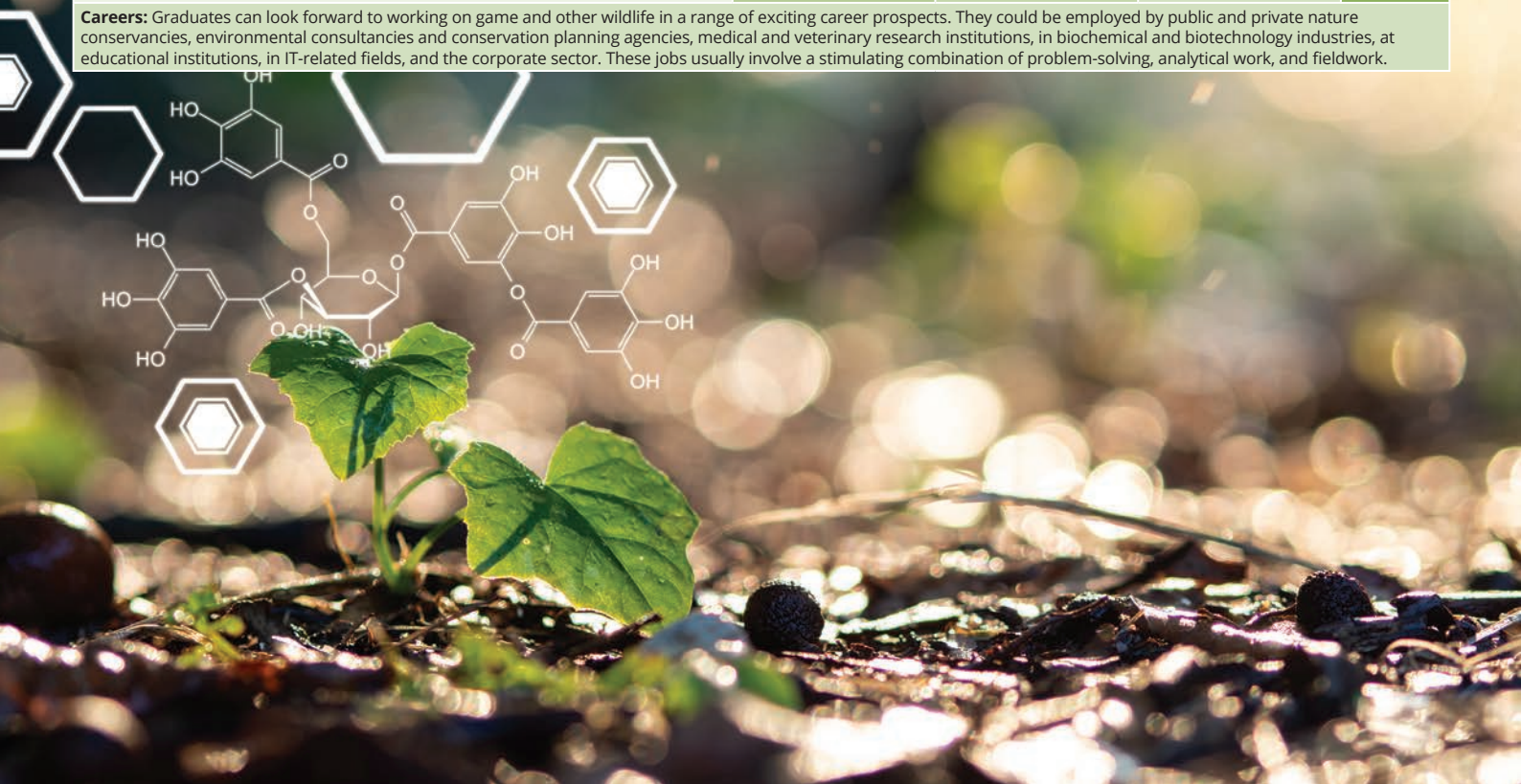
- The following persons will be considered for admission: Candidates who have a certificate that is deemed by the University to be equivalent to the required National Senior Certificate with university endorsement, candidates who are graduates from another tertiary institution or have been granted the status of a graduate of such an institution, and candidates who are graduates of another faculty at the University of Pretoria.
- Life Orientation is excluded from the calculation of the Admission Point Score (APS).
- Grade 11 results are used for the conditional admission of prospective students. Final admission is based on the final NSC/IEB results.
- **BSc (Biological Sciences) programme:** This is a generic first-year programme in biological sciences. Only first-time university entry students who are uncertain about which specialisation degree programme to choose, may apply for this programme.
- **MBChB or BChD selection:** Students who intend to apply for admission to MBChB or BChD in the second semester, when places become available in these programmes, may register for any BSc biological sciences modules in the first semester, replacing Mathematics (WTW 134) with Science and World Views (FIL 155), People and their Environment (MGW 112) and Medical Terminology (MTL 180), with the proviso that should they not be selected and should they wish to continue with one of the biological sciences programmes, they must complete Mathematics (WTW 165) in the second semester of their first year. Students who wish to add these three modules (FIL 155, MGW 112 and MTL 180) are required to have an APS of at least 35 and a minimum of 70% for Mathematics in the final NSC or equivalent qualification. Students should contact the Faculty of Health Sciences for their added criteria.
- **BVSc and BVetNurs selection:** Students who intend to apply for admission to BVSc may register for BSc (Biological Sciences) modules including Medical Terminology (MTL 180). Applicants enrolled in the extended BSc programmes must complete the first 3 semesters of the BSc – Extended programme with the correct (equivalent) modules to be eligible for selection into the BVSc or BVetNurs programme. Students should contact the Faculty of Veterinary Science for their selection criteria.
- **BSc Extended programmes:**
 - Candidates who do not comply with the minimum admission requirements for a BSc and BScAgric mainstream programme, may be considered for admission to the corresponding BSc Extended programme, which requires an additional year of study.
 - The BSc Extended programmes are not available for students who meet all the requirements for the corresponding mainstream programme.
 - Only students who apply in their final NSC or equivalent qualification year will be considered for admission into any of the BSc Extended programmes. This, however, excludes students who are upgrading or taking a gap year.

Undergraduate programmes

University of Pretoria website

www.up.ac.za/nas

Programmes	Minimum requirements for NSC and IEB for 2023			
	Achievement level			APS
BIOLOGICAL SCIENCES	English Home Language or English First Additional Language	Mathematics	Physical Sciences	
BSc (Biological Sciences) Close on availability of space: As soon as the number of places available for this programme are filled, it will be closed for further applications.	5	5	5	32
This is a generic first-year programme in Biological Sciences. Only first time university entry students who are uncertain about which specialisation degree programme to choose may apply for this programme.				
BSc (Biochemistry) [3 years] Close on availability of space: As soon as the number of places available for this programme are filled, it will be closed for further applications.	5	5	5	32
Careers: Biochemistry offers many opportunities for exciting and challenging careers in the food and pharmaceutical, fine chemicals and waste-processing industries. Careers at research councils, such as the Medical Research Council (MRC), the Agricultural Research Council (ARC), the Cancer Association of South Africa (CANSa) and the Water Research Commission (WRC) are possibilities, as are academic institutions, the Council for Scientific and Industrial Research (CSIR) and forensic as well as pathology laboratories. Possible careers include that of researcher, teacher, lecturer and medical representative. Graduates are comfortable in work environments such as universities, research institutes, pharmaceutical companies, biotechnology companies and related industries.				
BSc (Biotechnology) [3 years] Close on availability of space: As soon as the number of places available for this programme are filled, it will be closed for further applications.	5	5	5	32
Careers: Graduates mostly find work as laboratory-based researchers or bio-entrepreneurs using medical, animal, plant or microbe-based technologies to develop products and services. If students combine biotechnology with additional qualifications such as law, they will be equipped for success in careers such as patent law, pharmaceutical sales and marketing, project management, computer programming (natural computation) and science journalism. Please note that the level of training and qualification plays a vital role in determining the type of work a qualified biotechnologist can pursue.				
BSc (Ecology) [3 years] Close on availability of space: As soon as the number of places available for this programme are filled, it will be closed for further applications.	5	5	5	32
Careers: Graduates will be at the forefront of conserving natural ecosystems in a changing world. They find work in environmentally based government and private conservation organisations, companies involved in the direct or indirect use of natural resources, environmental consultancies, environmental education initiatives, and academic and training institutions.				
BSc (Zoology) [3 years] Close on availability of space: As soon as the number of places available for this programme are filled, it will be closed for further applications.	5	5	5	32
Careers: Graduates can look forward to working on game and other wildlife in a range of exciting career prospects. They could be employed by public and private nature conservancies, environmental consultancies and conservation planning agencies, medical and veterinary research institutions, in biochemical and biotechnology industries, at educational institutions, in IT-related fields, and the corporate sector. These jobs usually involve a stimulating combination of problem-solving, analytical work, and fieldwork.				



Undergraduate programmes

Programmes	Minimum requirements for NSC and IEB for 2023			
	Achievement level			APS
	English Home Language or English First Additional Language	Mathematics	Physical Sciences	
BIOLOGICAL SCIENCES BSc (Entomology) [3 years] Close on availability of space: As soon as the number of places available for this programme are filled, it will be closed for further applications. Careers: Graduates with expertise in entomology are highly sought after in the agricultural sector as insect management specialists or researchers. They are also employed at nature reserves, environmental consultancies, conservation planning agencies, medical and veterinary research institutions, educational institutions and museums, organisations involved in the management of invasive species and pests, quarantine and inspection services, in the biochemical and biotechnology industries, in IT-related fields, and in the corporate sector.	5	5	5	32
BSc (Genetics) BSc (Human Genetics) [3 years] Close on availability of space: As soon as the number of places available for this programme are filled, it will be closed for further applications. Careers: Graduates generally choose to work as molecular biologists, medical or clinical geneticists, cytogeneticists, biotechnologists, agricultural scientists, molecular ecologists, forensic scientists, genetic counsellors, bioinformaticists and computational analysts, veterinary scientists, teachers or lecturers at various institutions, and in bioscience-related industries. If students combine genetics with additional qualifications such as law, they will be equipped for successful careers in, for example, patent law, pharmaceutical sales and marketing, project management, computer programming (natural computation) and science journalism. Note that the level of training and qualification plays an important role in determining the type of work in which a qualified geneticist can become involved.	5	5	5	32
BSc (Human Physiology) BSc (Human Physiology, Genetics and Psychology) [3 years] Close on availability of space: As soon as the number of places available for this programme are filled, it will be closed for further applications. Careers: Research is performed in cooperation with medical teams in private and government research laboratories (such as the CSIR and the MRC), the South African Bureau of Standards (SABS), pharmaceutical firms, universities, veterinary and industrial institutions and state departments (eg the Department of Health). Physiologists are also found in various other fields, including education (teachers, lecturers and instructors), sports physiology, biostatistics, bioengineering, industrial hygiene, journalism and medical technology, and in the industry as representatives of pharmaceutical firms. Graduates with Genetics and Psychology as subjects also have access to postgraduate programmes offered by the Department of Biochemistry, Genetics and Microbiology (Faculty of Natural and Agricultural Sciences) and the Department of Psychology (Faculty of Humanities).	5	5	5	32
BSc (Medical Sciences) [3 years] Close on availability of space: As soon as the number of places available for this programme are filled, it will be closed for further applications. Careers: Postgraduate studies are highly recommended. Honours, master's and doctoral degrees can be obtained in any of the subdisciplines of anatomy: neuro-anatomy, clinical anatomy, cell biology, physical and forensic anthropology, histology and embryology. Students who obtain this degree can also continue with their studies to obtain postgraduate degrees in physiology, genetics and pharmacology. Career opportunities include research in any of the subdisciplines of anatomy, in academia, in forensic science and in the health science industry. Other careers that can be considered are in the sports sciences, virology, chemical pathology, immunology, health administration or ergonomics. Technical careers are also possible, for example, in the Anatomy or Physiology departments at universities. Limited places are available in the first year of BSc (Medical Sciences). Students who apply for BSc (Medical Sciences) as their first choice, and who meet the minimum admission requirements, will be admitted until the places have been filled. Transfers from the extended programme are allowed after three semesters in the extended programme only if students comply with all of the prerequisites for ANA 121, ANA 122 and ANA 126 (CMY 117 and MLB 111, or their equivalent, passed).	5	5	5	32
BSc (Microbiology) [3 years] Close on availability of space: As soon as the number of places available for this programme are filled, it will be closed for further applications. Careers: Microbiologists can pursue a variety of careers involving activities ranging from practical application to basic research. Career opportunities are available in the food, dairy, beer, wine, baker's yeast and fermentation industries, and at mines where they will be involved in corrosion control. Graduates can also follow careers in medical or veterinary microbiology, microbial genomics and, ecology or as researchers at organisations such as the CSIR, MRC or ARC, or lecturers and researchers at academic institutions.	5	5	5	32
BSc (Plant Science) [3 years] Close on availability of space: As soon as the number of places available for this programme are filled, it will be closed for further applications. Careers: Careers range from working in a laboratory to studying plants in their natural environments. Graduates could be employed at biotechnology and pharmaceutical firms, South African National Parks (SANParks), private ecological companies and research institutions such as the CSIR, ARC and the South African National Biodiversity Institute (SANBI).	5	5	5	32
BSc – Extended programme – Biological and Agricultural Sciences Refer to the faculty-specific information on page 2.	4	4	4	26

Students enrolled for the BSc – Extended programme – Biological and Agricultural Sciences, do not qualify to apply for the mid-year intake in the Faculty of Health Sciences.

Undergraduate programmes



Programmes	Minimum requirements for NSC and IEB for 2023			
	Achievement level			APS
AGRICULTURAL AND FOOD SCIENCES	English Home Language or English First Additional Language	Mathematics	Physical Sciences	
BSc (Culinary Science) [4 years] Close on availability of space: As soon as the number of places available for this programme are filled, it will be closed for further applications.	5	5	5	32
Careers: Graduates can be employed as culinary scientists, culinologists, sensory analysts, food researchers, food product developers, food safety and quality assurance managers, and food service managers.				
BSc (Food Science) [3 years] Close on availability of space: As soon as the number of places available for this programme are filled, it will be closed for further applications.	5	5	5	32
Careers: Food scientists with highly marketable training and professional skills work as food risk investigators, quality and safety assurance managers, food chemists, food microbiologists and biotechnologists, packaging and shelf-life specialists, safety auditors, product and process development managers, technical sales and marketing advisors, sensory scientists or food bio-scientists (for example brewers or flavourists) in the food, agro-processing and related industries. The work environments of food scientists include laboratories, food production sites, business premises (retail and wholesale), training areas, government institutions and research organisations. Food scientists also work in industries and companies that manufacture and supply materials (for example packaging and food additives, such as colourants and flavourants) to the food industry, or have secondary involvement in food production and sales.				
BSc (Nutrition) [4 years] Close on availability of space: As soon as the number of places available for this programme are filled, it will be closed for further applications.	5	5	5	32
BSc (Nutrition) is an interfaculty degree programme, presented jointly by Consumer and Food Sciences (Faculty of Natural and Agricultural Sciences) and Human Nutrition (Faculty of Health Sciences). Careers: The need for graduates with training in nutrition is driven by the worldwide recognition of the fact that food does not only meet basic nutritional needs but also plays a key role in the promotion and maintenance of long-term good health. Career opportunities exist in food or related industries (such as pharmaceutical and food manufacturing companies), government departments, international organisations (such as the United Nations Food and Agricultural Organisation (FAO) and the World Health Organisation (WHO)), NGOs, research organisations and as project managers and advisors in the food, health and consumer sectors.				
BScAgric (Agricultural Economics and Agribusiness Management) [4 years] Close on availability of space: As soon as the number of places available for this programme are filled, it will be closed for further applications.	5	5	5	32
Careers: The BScAgric (Agricultural Economics and Agribusiness Management) degree is ideal for students who are passionate about and have competencies in both science and business subjects. The degree programme cultivates problem solvers with unique skill sets to help feed and clothe the world. Agricultural economists are involved in many different areas of the economy. Their roles in the economy include: analysing and understanding consumer behaviour in terms of people's wants, needs and willingness to pay for food and clothing; conducting research in environmental economics to assist governments and businesses in ensuring the sustainable use of scarce resources such as water; training of smallholder farmers by providing extension services; trading of financial instruments and agricultural commodities on global and local stock markets; advising clients in the agricultural sector on how to manage their finances and risks; advising government on how to ensure that there will be enough food for all South Africans; and conducting research to ensure the sustainable and profitable supply of food and clothing across the various supply chains. Employment opportunities for agricultural economists include employment in the government, commercial banks, multinational agribusiness companies, former cooperatives, commodity trading houses, food processors and manufacturers, and research councils.				
BScAgric (Animal Science) [4 years] Close on availability of space: As soon as the number of places available for this programme are filled, it will be closed for further applications.	5	5	5	32
Careers: Animal science is focused on the application of the scientific aspects of animal production and the quality control of products to ensure consumer satisfaction. Careers in this field make an essential contribution to food (protein) production in South Africa. Based on the most recent research and the needs of both animals and humans, animal science focuses on the entire livestock production value chain, from conception to consumption.				
There are numerous career opportunities for animal scientists in research, commercial farming and the public sector, and for in the livestock and feed industry. Animal scientists can work on different levels in these sectors, eg as researchers or consultants on animal nutrition or breeding, technical representatives, managers of intensive and extensive animal production systems and policymakers.				
The BScAgric (Animal Science) degree is acknowledged as a professional qualification by SACNSP in terms of Act 106 of 1993. It is internationally recognised, which means that graduates can register as professional animal scientists.				

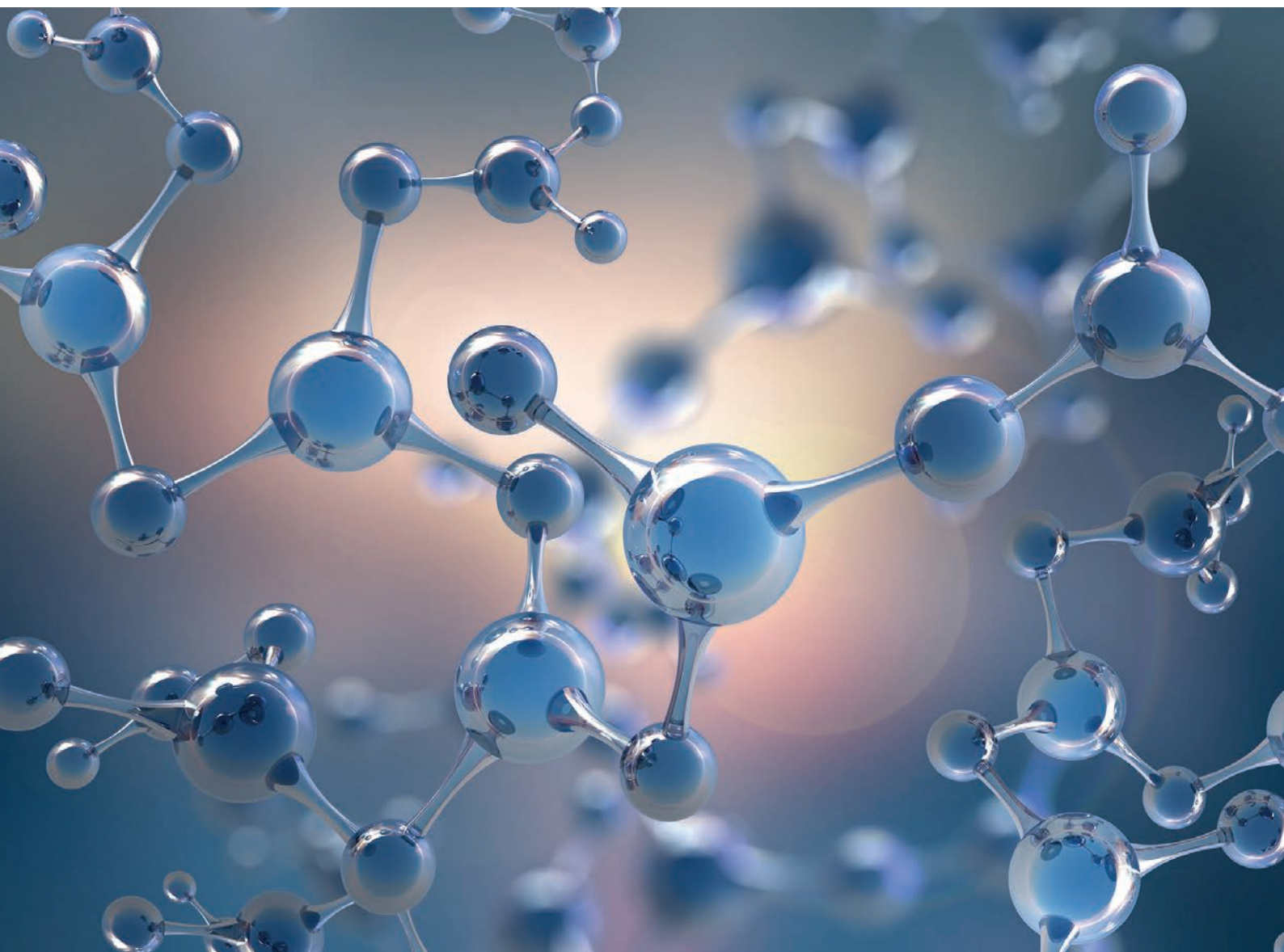
Undergraduate programmes

Programmes	Minimum requirements for NSC and IEB for 2023			
	Achievement level			APS
AGRICULTURAL AND FOOD SCIENCES	English Home Language or English First Additional Language	Mathematics	Physical Sciences	
BScAgric (Plant Pathology) [4 years] Close on availability of space: As soon as the number of places available for this programme are filled, it will be closed for further applications.	5	5	5	32
Careers: Graduates could be employed in: <ul style="list-style-type: none"> ▪ Education and training: GGraduates can work at universities, colleges and schools. ▪ Plant pathologists: Graduates are in demand in various industries. Careers range from researchers to practitioners who work in laboratories, on commercial farms (which includes fieldwork) or in the food trade industry. ▪ Research and management: Graduates are also hired at research institutes, government departments, seed, fertiliser and agrochemical companies, municipalities and in the mining industry. ▪ Extension services for technology transfer: Employers of graduates include grower associations, national and provincial Departments of Agriculture, Land Reform and Rural Development (DALRRD), Environment, Forestry and Fisheries (DEFF), Tourism (DT), Mineral Resources and Energy (DMRE) and Water and Sanitation (DWS). ▪ Entrepreneurial: Graduates can work as consultants or in production. 				
BScAgric (Applied Plant and Soil Sciences) [4 years] Close on availability of space: As soon as the number of places available for this programme are filled, it will be closed for further applications.	5	5	5	32
Careers: Graduates could be employed as teachers and lecturers at schools and academic institutions, as well as researchers and managers at various public and private institutions: <ul style="list-style-type: none"> ▪ Public sector: The ARC, DWS, DEFF, DT, DALLRD, DMRE, the CSIR, provincial agriculture and nature conservation departments, SANBI, municipalities, SANParks, national farming and food production agencies ▪ Private sector: Companies involved in seed, fertiliser and plant protection research and development, environmental planning and management, nurseries, vegetable, fruit and ornamental cut-flower production and irrigation ▪ Extension services involving knowledge transfer: Nature conservation, national and provincial departments of agriculture and the environment, environmental management and rehabilitation, nurseries, crop, turfgrass and weed management, private companies servicing field crops, vegetables, medicinal and aromatic plants, fruit, ornamental and cut-flower production ▪ Entrepreneurial: Consultants in crop, pasture, vegetable, medicinal and aromatic plants, ornamental and cut-flower production systems and landscaping enterprises, managing own farms and nurseries for extensive (field) or intensive (tunnel/greenhouse) production systems involving various crops, and managing companies specialising in irrigation, reclamation and soil conservation 				
BSc – Extended programme – Biological and Agricultural Sciences Refer to the faculty-specific information on page 2.	4	4	4	26
Students who are placed on this BSc – Extended programme will take a minimum of five years to complete any BScAgric, BSc (Culinary Science) or BSc (Nutrition) programmes.				

Programmes	Minimum requirements for NSC and IEB for 2023		
	Achievement level		APS
CONSUMER SCIENCE	English Home Language or English First Additional Language	Mathematics	
BConSci (Clothing: Retail Management) [4 years] Close on availability of space: As soon as the number of places available for this programme are filled, it will be closed for further applications.	5	4	28
Careers: Graduates can be employed in retail management as brand managers, clothing buyers and planners, fashion designers, fashion marketers, fashion product developers, quality controllers and assurance managers, store managers, image consultants, textile technologists, visual merchandisers and pattern technologists, or can become entrepreneurs.			
BConSci (Food: Retail Management) [4 years] Close on availability of space: As soon as the number of places available for this programme are filled, it will be closed for further applications.	5	4	28
Careers: Graduates can be employed as brand managers, sales managers or store managers, food and beverage buyers and planners, food stylists, food journalists, food product marketers, visual merchandisers and consumer consultants, or can become entrepreneurs.			
BConSci (Hospitality Management) [4 years] Close on availability of space: As soon as the number of places available for this programme are filled, it will be closed for further applications.	5	4	28
Careers: Graduates can be employed as food and beverage managers, food service managers, culinary specialists, events coordinators, entrepreneurs, food product and menu developers, food journalists, food safety and quality assurance managers, and food stylists.			

Undergraduate programmes

Programmes	Minimum requirements for NSC and IEB for 2023			
	Achievement level			APS
PHYSICAL SCIENCES	English Home Language or English First Additional Language	Mathematics	Physical Sciences	
BSc (Chemistry) [3 years] Close on availability of space: As soon as the number of places available for this programme are filled, it will be closed for further applications.	5	5	5	34
Careers: Graduates are employed in most technology-based institutions and work in laboratory environments that form part of industrial, research or academic institutions. A chemist must be able to participate in teamwork in a multidisciplinary environment and a wide variety of enterprises in both the private and public sectors. It is important to note that the type of work available to a graduate in chemistry depends on the level of the qualification obtained. Advanced qualifications will eventually lead to positions in research and/or production management and require management and financial planning skills. Many career opportunities exist in the fields of education, research, journalism, environmental protection, food and beverages, energy, water, health, sports, pharmaceuticals and cosmetics, geology, mining and law enforcement. These include the well-known professions of synthetic chemist, materials scientist, chemical pathologist, forensic chemist, analytical chemist, drug analyst, patent lawyer, environmental chemist, geochemist, food chemist, polymer chemist and soil chemist.				
BSc (Physics) [3 years] Close on availability of space: As soon as the number of places available for this programme are filled, it will be closed for further applications.	5	5	5	34
Careers: Graduates could be employed as university academics, whose duties include lecturing, research and the supervision of postgraduate students, researchers in national laboratories such as the Nuclear Energy Corporation of South Africa (NECSA), the South African Astronomical Observatory or iThemba LABS (Laboratory for Accelerator-based Sciences), researchers in industry, for example at the CSIR or Element Six, science advisors for non-governmental organisations, industry or government, radiation scientists, medical scientists and biophysicists, atmospheric scientists and climatologists, developers of renewable energy sources, geophysicists, innovators and entrepreneurs, and computational scientists. International collaboration also takes place with experts from abroad.				



Undergraduate programmes

Programmes	Minimum requirements for NSC and IEB for 2023			
	Achievement level			APS
	English Home Language or English First Additional Language	Mathematics	Physical Sciences	
PHYSICAL SCIENCES BSc (Geography and Environmental Sciences) [3 years] Close on availability of space: As soon as the number of places available for this programme are filled, it will be closed for further applications. Careers: Geography and environmental sciences offer a range of career paths, including teaching, research (for a variety of bodies) and the application of geographical knowledge and skills in practice. Graduates can focus on environmental management; urban issues such as informal settlements; regional and rural development; and environmental health or environmental issues, including pollution, climate change and the understanding and addressing of negative impacts on biodiversity/ecosystem services through activities such as mining, agriculture and tourism. Environmental specialists act as consultants in the fields of environmental analysis and management, environmental law, environmental standards, environmental management systems and environmental auditing. They are needed by, among others, professionals in private sector institutions involved with environmental issues, for example, transport and civil engineers, town and regional planners and landscape architects. In the private sector, graduates are generally employed by real estate, planning, architectural and engineering firms, and by banks, tourism organisations, environmental conservation bodies and industry. Government departments such as the Departments of Environment, Forestry and Fisheries (DEFF), Agriculture, Land Reform and Rural Development (DALRRD), Water and Sanitation (DWS), Tourism (DT), Basic Education (DBE) and Higher Education and Training (DHET), and Statistics South Africa (Stats SA) also employ these graduates, as do parastatal organisations such as the South African Bureau of Standards (SABS), the South African Biodiversity Institute (SANBI) and the Council for Scientific and Industrial Research (CSIR). Many graduates are also self-employed, working mainly in areas such as marketing, planning, development, tourism, cartography, remote sensing, environmental analysis, social impact assessments and environmental auditing.	5	5	5	34
BSc (Geoinformatics) [3 years] Close on availability of space: As soon as the number of places available for this programme are filled, it will be closed for further applications. Careers: Graduates with a BSc (Geoinformatics) readily find work at organisations such as Geographic Information System (GIS) vendors (ESRI or Intergraph), the CSIR, GIS consultants (AfriGIS, GeoTerrimage, GISCOE), civil engineering consultants (Aurecon, SSI), the South African National Space Agency (SANSA), National Geospatial Information (NGI), or any municipality in the country. Many government departments (eg DEFF, DSI, Stats SA, DALRRD and DWS) also employ GISc professionals. The South African Geomatics Council has accredited the BSc Geoinformatics and BScHons Geoinformatics programmes. BSc Geoinformatics graduates can register as GISc Candidate Technologists, and BScHons Geoinformatics graduates can register as GISc Candidate Professionals.	5	5	5	34
BSc (Geology) [3 years] Close on availability of space: As soon as the number of places available for this programme are filled, it will be closed for further applications. Careers: Large international mining companies are significant employers of geologists and other geoscientists in research, exploration and mining projects. However, employment is increasingly to be found in smaller, entrepreneurial firms ('juniors'). The Council also offers exciting careers for Geosciences, the CSIR, and the Council for Mineral Technology (MINTeK), DWS, and at museums, engineering firms and consulting companies. Graduates may even operate as self-employed consultants in their own firms. Laboratory specialists, for example, mineralogists, identify and examine minerals using sophisticated instruments and analytical equipment. Environmental and engineering geologists study the interaction between human activities and the geological environment, such as the pollution of soil and groundwater. They investigate geological structures and soil, and rock properties at construction sites, for example, dams, tunnels and mines, to provide valuable information before construction. They also locate and evaluate suitable construction materials. The task of the hydrogeologist is to look for groundwater and monitor the responsible exploitation of that water.	5	5	5	34
BSc (Meteorology) [3 years] Close on availability of space: As soon as the number of places available for this programme are filled, it will be closed for further applications. Careers: Meteorologists are employed by institutions involved in the study, interpretation and prediction of weather and climate-related phenomena. The South African Weather Service (SAWS), the CSIR, some universities, agricultural institutions and general industries employ meteorologists who practise mainly as specialists in the following areas: <ul style="list-style-type: none"> Researchers: They research all aspects of the weather and climate to improve man's understanding of atmospheric phenomena. Atmospheric modellers use supercomputers to solve complex flow dynamic equations of the atmosphere. The monitoring of air quality and the modelling of the impact of air pollution on society are two important aspects that need to be addressed. Research on climate change is receiving increasing attention. Weather forecasters: The weather forecaster must analyse data and predict the weather by using models that are run on supercomputers. Weather forecasts are issued on different time scales, from very short-range forecasting to forecasts that are valid for months ahead, as well as seasonal forecasts. Private positions for people with this qualification include presenting the weather forecast on television. Climatologists: They manage essential data sets that contain large volumes of information gathered by the SAWS and other organisations. Consultants: Some meteorologists who work as consultants in the private sector and at universities provide specialised research services. Lecturers: A few academic positions for meteorologists and climatologists are available at South African universities. They ensure that the training of meteorologists meets international standards. The BScHons Meteorology degree, which is required to become a professional meteorologist, complies fully with the Manual on the Implementation of Education and Training Standards in Meteorology and Hydrology Volume I – Meteorology.	5	5	5	34
BSc (Engineering and Environmental Geology) [3 years] Close on availability of space: As soon as the number of places available for this programme are filled, it will be closed for further applications. Careers: Engineering and environmental geologists study the interaction between human activities and the geological environment, such as the pollution of soil and groundwater. They investigate geological structures and soil and rock properties at construction sites, for example, dams, tunnels and mines, to provide valuable information before construction. They also locate and evaluate suitable construction materials. The task of the hydrogeologist is to search for groundwater and monitor the responsible exploitation of that water.	5	5	5	34
BSc – Extended programme – Physical Sciences Progression from the BSc – Extended programme to the mathematic intensive programmes will be considered only for students who obtained a GPA of 65% in all their first-year modules.	4	4	4	28

Undergraduate programmes

Programmes	Minimum requirements for NSC and IEB for 2023		
	Achievement level		APS
MATHEMATICAL SCIENCES	English Home Language or English First Additional Language	Mathematics	
BSc (Actuarial and Financial Mathematics) [3 years] Close on availability of space: As soon as the number of places available for this programme are filled, it will be closed for further applications.	5	7	36
Careers: Actuarial and financial mathematics is a popular field, with career opportunities in the business market and at investment institutions such as banks and insurance companies. Mathematical skills are essential in portfolio management and the modelling of financial risk. This programme prepares students for professional careers as actuaries or financial engineers. The activities of actuaries or actuarial technicians include long-term capital projects, designing the benefits of medical schemes, pension fund management, the determination of contributions and financial management on a sound long-term basis, the evaluation of investments in shares, property and other transactions, and the determination of the premiums and reserves for insurers' outstanding claims. Financial engineers can be employed by banks and financial institutions, brokerage firms and investment institutions. The mathematical skills of financial engineers are essential in portfolio and risk management. Activities include asset management (trading in bonds, futures and derivative instruments such as options), designing new financial products and devising strategies to control credit risk.			
BSc (Mathematics) BSc (Applied Mathematics) [3 years] Close on availability of space: As soon as the number of places available for this programme are filled, it will be closed for further applications.	5	6	34
Careers: Graduates in mathematics and applied mathematics are employed by research institutions, educational bodies (universities and schools), the public sector (government and medical institutions) and the private sector (engineering companies, financial institutions and the computer industry). These graduates' training in abstract, analytical and computational thinking provides them with the background required to easily adjust to changing circumstances in the professional environment and to construct mathematical models of natural, technological and financial phenomena. Mathematicians and applied mathematicians apply, evaluate and adapt existing problem-solving techniques, or develop new techniques to solve problems.			
BSc (Mathematical Statistics) [3 years] Close on availability of space: As soon as the number of places available for this programme are filled, it will be closed for further applications.	5	6	34
Careers: By completing this programme you will therefore be positioned at the forefront of analytical thinking and application in the statistical, computational and interdisciplinary environments of the future. What career opportunities exist for you as a graduate? Many professions amongst others: Data scientist, data analyst, financial risk analyst, financial analyst, geospatial information analyst, biostatistician, statistical software engineer. Some examples of career opportunities are: <ul style="list-style-type: none"> Google Analytics use statistics to track internet users to generate leads for their recommended engines. Movement information captured by cell phones is used by statistical predictive models to predict traffic congestion and suggest faster routes. Statisticians make use of statistical methodologies to detect fraud, assist with credit-related portfolios and forecast financial-economic trends. Retail companies study customer satisfaction and customer experience by using statistical models. Statisticians are prominent in the modelling of climate change, crime hotspots, rhino-poaching, diseases, etc. Statisticians advise animal scientists on factors affecting animal nutrition and genetic breeding plans. Government employs statisticians to understand population demographics, health risks and other factors that influence sustainable development programmes. 			
BSc – Extended programme – Mathematical Sciences Refer to the faculty-specific information on page 2.	4	5	28
Progression from the BSc – Extended programme to the mathematics-intensive programmes will be considered only for students who obtained a GPA of 65% in all their first-year modules. Students who pass all their first-year modules will be advised on alternative academic pathways. Admission to the BSc (Actuarial and Financial Mathematics) programme will be considered only in the case of students who passed IAS 111 and achieved a minimum mark of 60% in WTW 153 and WST 153.			

Single, double and triple major degree programmes

Although programmes are more generic during the first year to provide sound foundations, students who progress to the second year are advised to carefully consider the combinations that may be possible in their second and third years, which strongly relate to each other concerning prerequisites. Explanatory infographics can be seen on the NAS Faculty web page at www.up.ac.za/faculty-of-natural-agricultural-sciences/article/2956330/infographics, and detailed information is provided in the yearbook at www.up.ac.za/yearbooks/home.

The BConSci and BScAgric degrees have relatively fixed curricula, but most of these programmes are multidisciplinary. The other NAS programmes offer a variety of combinations. There are 12 biological sciences programmes, which represent more than

50 possibilities for single or double majors, and even one triple major degree programme. Single major degrees can be obtained in most disciplines, but they all offer double major combinations to make it possible for graduates to choose either one of their majors for postgraduate study. In the physical sciences, there are six programmes, but more than 20 combinations.

There are several single major degrees (eg Engineering and Environmental Geology), but Chemistry, Geology and Physics offer double majors. The mathematical sciences offer similar possibilities, with two streams in the professional programme in Actuarial and Financial Mathematics, and double major options in the Applied Mathematics, Mathematics and Mathematical Statistics programmes.



BSc – Extended programmes

Biological and Agricultural Sciences stream:

Gateway/pipeline to all Biological and Agricultural Sciences as well as programmes in Health Sciences.

Mathematical stream:

Gateway/pipeline to Mathematical Sciences and Statistics

Physical Sciences stream:

Gateway/pipeline to Physics, Chemistry, Geology, Geography, Environmental Sciences, Geoinformatics and Meteorology as well as Engineering

The BSc – Extended programmes are designed for students who show potential to succeed, but are not academically well prepared. These programmes have lower entrance requirements and include an additional year of study to enhance the students' basic knowledge. The students who are successful are those who commit themselves to making good use of the opportunity offered to them.



What makes this programme unique?

During their first year, BSc – Extended programme students attend lectures at the Mamelodi Campus. Those who successfully complete their first year attend lectures on the Hatfield Campus from their second academic year onwards. They are credited for the modules successfully completed after 18 months (which are equivalent to the main programme's first semester modules).

Minimum admission requirements

Programmes	Minimum requirements for NSC and IEB for 2023			
	Achievement level			APS
	English Home Language or English First Additional Language	Mathematics	Physical Sciences	
Biological and Agricultural Sciences – BSc – Extended programme	4	4	4	26
Candidates who do not comply with the minimum admission requirements for the Agricultural and Food Sciences programmes may be considered for admission to the BSc – Extended programme – Biological and Agricultural Sciences, which requires an additional year of study.				
Physical Sciences – BSc – Extended programme	4	4	4	28
Candidates, who do not comply with the minimum admission requirements for the Physical Sciences programmes may be considered for admission to the BSc – Extended programme – Physical Sciences, which requires an additional year of study.				
Mathematical Sciences – BSc – Extended programme	4	5	-	28
Candidates, who do not comply with the minimum admission requirements for the Mathematical Sciences programmes may be considered for admission to the BSc – Extended programme – Mathematical Sciences, which requires an additional year of study.				

These programmes are not available for students who meet all the requirements for the corresponding mainstream programme.

Note: Only students who apply in the final year of their NSC or equivalent qualification will be considered for admission into any of the BSc – Extended programmes. Refer to page 2 for more information.

Graphic sourced and adapted from www.freepik.com

Biological Sciences

Anatomy

BSc (Medical Sciences)

The Department of Anatomy is part of the School of Medicine in the Faculty of Health Sciences and offers a BSc degree in Medical Sciences in the Faculty of Natural and Agricultural Sciences. Students are trained in the basic medical sciences, which include clinical anatomy, physical and forensic anthropology, histology, cell biology and embryology. These subjects can be combined with elective modules from physiology, pharmacology and genetics. Ideally, students who register for this degree should have a keen interest in research related to anatomy and the basic medical sciences.

What makes this programme unique?

Students are trained in the basic medical sciences, including clinical anatomy, physical anthropology and cell biology. During the course of their studies they work with human material, including human skeletal material, and do cadaver dissection.

What career opportunities exist for graduates?

Career opportunities exist in the field of research in any of the subdisciplines of anatomy, in academia, in forensic science and in the health science industry.

Other careers that may be considered are in sports science, virology, chemical pathology, immunology, health administration or ergonomics. Technical careers, for example in the Departments of Anatomy or Physiology at universities, are another possibility.

Which companies employ our graduates?

Graduates are sought after by institutes in the academic, government and private sectors, where they are employed as lecturers, researchers, medical and forensic scientists, and sales representatives in the medical and pharmacological industries. Several of our postgraduate students are currently studying at research facilities in North America and Europe.



Minimum admission requirements

Programme	Minimum requirements for NSC and IEB for 2023			
	Achievement level			APS
	English Home Language or English First Additional Language	Mathematics	Physical Sciences	
BSc (Medical Sciences) [3 years] Close on availability of space: As soon as the number of places available for this programme are filled, it will be closed for further applications.	5	5	5	32

Biological Sciences

Biochemistry, Genetics and Microbiology

BSc (Biochemistry)

Life at the cellular and molecular levels depends on the specific interaction and cooperation of many individual biomolecules. To understand life at a fundamental level, biochemists study the role of individual biomolecules and relate this function to its unique structure and its interactions with other molecules.

Challenges of global relevance, such as COVID-19, HIV/AIDS, malaria, tuberculosis, antimicrobial drug resistance and other human or animal diseases are addressed by using flow cytometry, biophysical analysis, protein crystallography, genome analysis, selective gene expression and metabolic profiles.

Biochemists can work in medicine, veterinary science, the food and pharmaceutical industries, agricultural research and many other fields.

First-year students are exposed to a range of biological, physical and mathematical science subjects to provide them with a firm scientific basis. In the second and third years, they delve deeper into biochemistry, combining theoretical lectures with appropriate practical studies to learn the principles and methodology of best biochemical practice. In the third year, the genome, transcriptome, proteome and metabolome of a living cell is studied and proteome analysis, crystallography, cell structure and function, enzymology and immunology are applied to understand the molecular basis of disease.

Ideally, biochemistry is combined with chemistry, genetics, human physiology, microbiology, plant science and zoology, which all include both theoretical and practical aspects. Students may choose elective modules related to their studies.

Who is the ideal candidate?

A candidate for the BSc (Biochemistry) programme should be motivated, innovative, persistent, meticulous and curious about life.

What makes this programme unique?

This degree falls under the Department of Biochemistry, Genetics and Microbiology and provides a firm basis for a career in the life sciences.

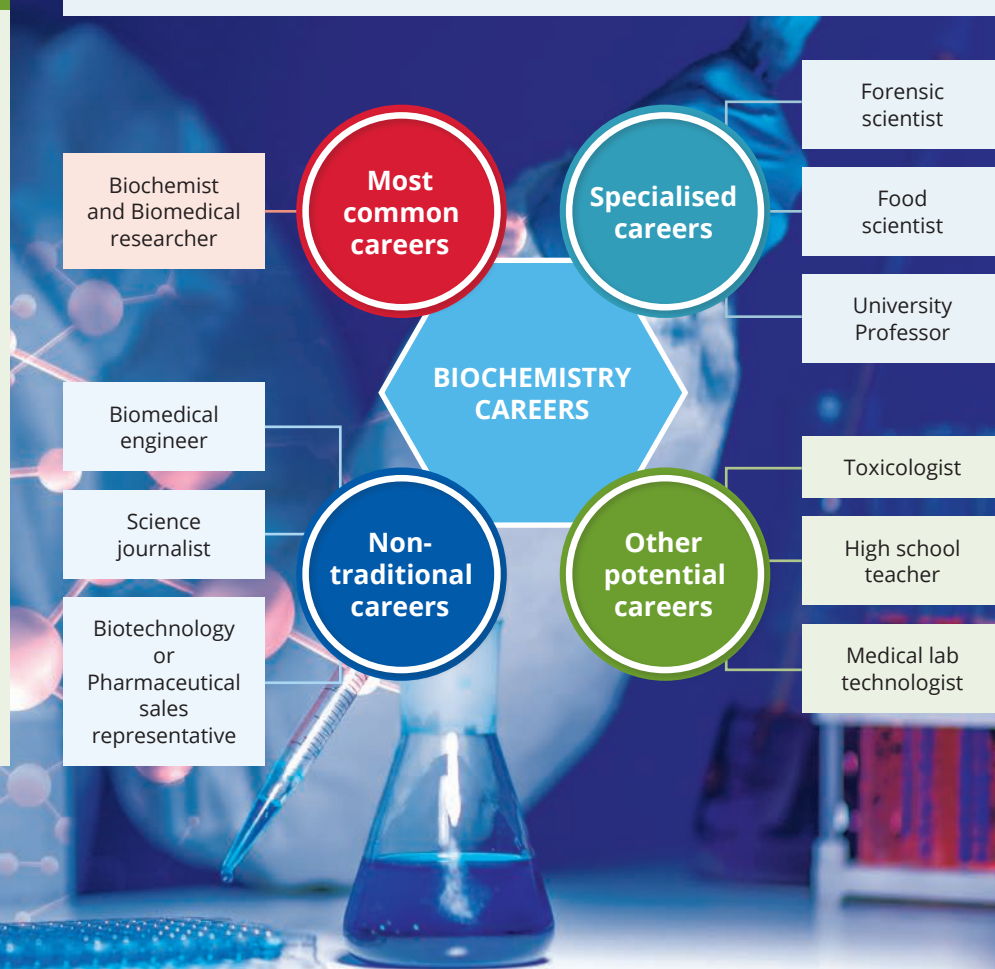
First-year students are exposed to a range of biological and physical science subjects to ensure a firm scientific basis. In the second and third years, they delve deeper into biochemistry, combining theoretical lectures with appropriate practical studies to learn the principles and methodology of research.

Ideally, biochemistry is combined with chemistry, microbiology, genetics, human physiology, plant science, zoology and/or food science.

Transferable skills gained while studying biochemistry include critical observation and analysis, project planning, report writing, time management, problem solving, logical thinking and computer literacy.

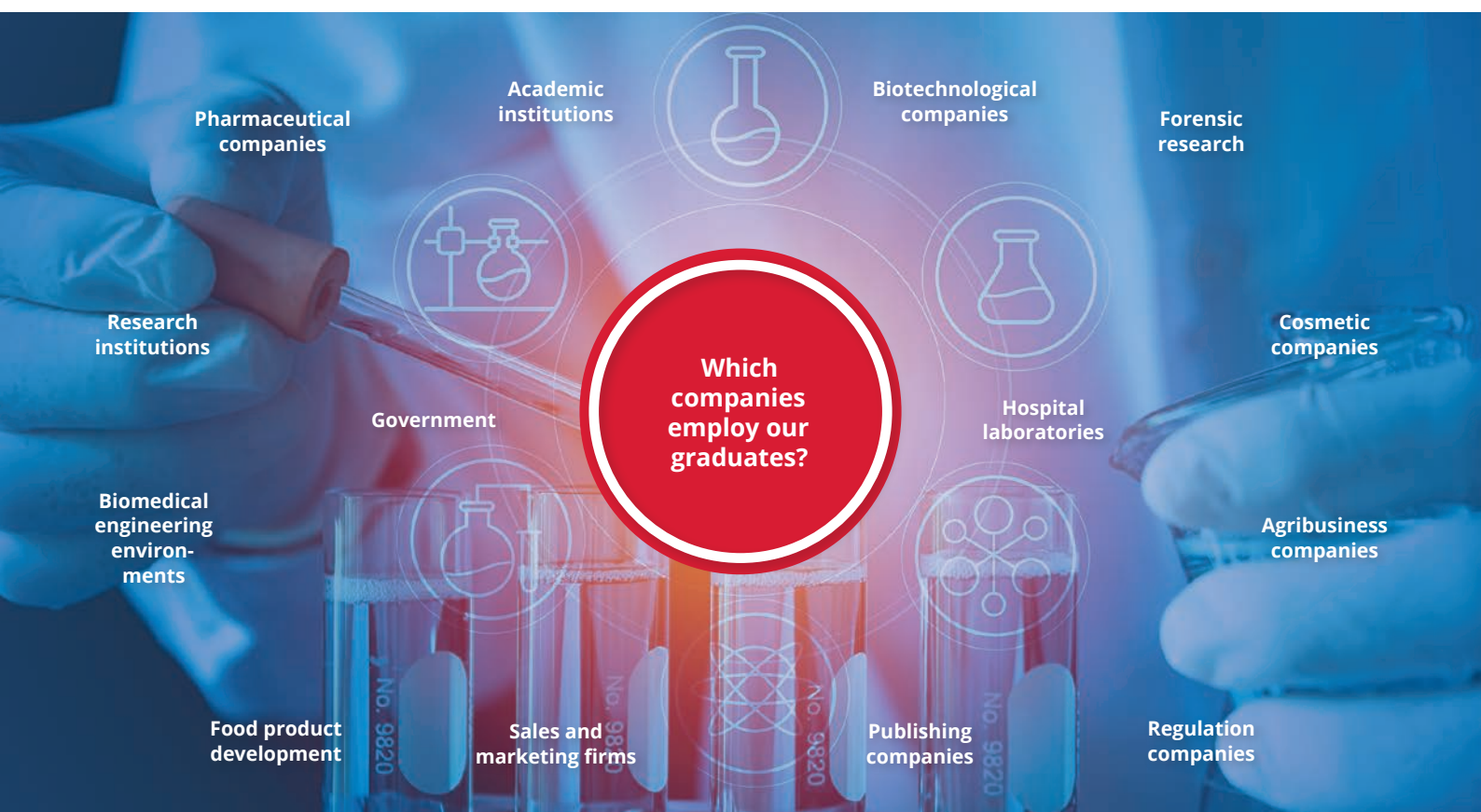
What career opportunities exist for graduates?

Biochemistry offers many opportunities for exciting and challenging careers in medical research and in the food and pharmaceutical, fine chemicals and waste processing industries. Possible employers are academic institutions, research councils such as the Medical Research Council (MRC), the Agricultural Research Council (ARC), the Cancer Association of South Africa (CANSA) and the Water Research Commission (WRC), and applied research agencies such as the Council for Scientific and Industrial Research (CSIR) and forensic and pathology laboratories. Career opportunities include those of researcher, lecturer, teacher and medical representative. Graduates are comfortable in work environments such as universities, research institutes, pharmaceutical and biotechnology companies and related industries.



Biological Sciences

Biochemistry, Genetics and Microbiology



'I am fascinated by nature and science and could not have asked for a better degree. This incredible three-year degree gave me insight into how science and nature combine to produce something amazing.

I have also learnt how to recognise, understand and interpret key concepts, especially in the fields of biochemistry, genetics and microbiology. The skills and abilities acquired throughout the course have ensured that I will have access to career opportunities in industry and academia.

I am currently enrolled for postgraduate studies at UP and am involved in researching new ways to combat malaria.'

– **Henrico Langeveld: MSc (Biochemistry)**



'The theoretical and practical aspects of this degree contributed to my intellectual development. What I enjoyed most about the course was the endless opportunities it offered

to gain more knowledge by attending research seminars and annual symposiums. Using the knowledge of botany gained during my studies, I have started my own nursery at home. I have also been able to put my knowledge of chemistry and biochemistry to good use and have started a chemicals company where household chemicals are produced. We are currently in the process of obtaining SABS approval for our products.

My future plans include collaborating with other graduates to open our own pharmacy. The broad scope of this degree provides the basis for a wide range of entrepreneurial ventures, but also qualifies graduates for good employment opportunities in companies that require the scarce skills developed by the programme.'

– **Meshack Kekana: MSc (Biochemistry)**

Minimum admission requirements

Programme	Minimum requirements for NSC and IEB for 2023			
	Achievement level			APS
	English Home Language or English First Additional Language	Mathematics	Physical Sciences	
BSc (Biochemistry) [3 years] Close on availability of space: As soon as the number of places available for this programme are filled, it will be closed for further applications.	5	5	5	32

Biological Sciences

Biochemistry, Genetics and Microbiology

BSc (Genetics), BSc (Human Genetics) & BSc (Biotechnology)

The Division of Genetics offers internationally recognised undergraduate and postgraduate degrees. Genetics is at the core of the biological, agricultural, veterinary and medical sciences and has become essential in fields as diverse as virology and epidemiology, biodiversity conservation and sustainable agriculture.

Single- and double-major options are offered in both the BSc (Genetics) and BSc (Human Genetics) programmes. Students can therefore choose to either specialise in genetics as a single major, or combine their genetics subjects with a second major, such as biochemistry, microbiology, plant science or zoology in the BSc (Genetics) programme, or with human physiology in the BSc (Human Genetics) programme.

The interdepartmental BSc (Biotechnology) programme places particular emphasis on molecular biology and is aimed at empowering students to pursue their interest in biotechnology. Undergraduate training includes exposure to aspects of biochemistry, genetics and microbiology, in addition to the other subjects chosen by the student.

Our degrees are research-oriented and place a strong emphasis on understanding underlying concepts and principles, as well as on developing the necessary problem-solving and analytical skills. Students are encouraged to decide on their postgraduate research direction during their undergraduate studies and to choose their electives accordingly.

Who is the ideal candidate?

Effective science is increasingly becoming transdisciplinary and involves multifaceted research teams and expertise.

Individuals seeking to enrol in programmes such as Genetics should be innovative and creative thinkers with curious minds who exhibit inquiry-driven tenacity, display a passion for life-science-related topics and have a fair understanding of mathematics.

What makes this programme unique?

At the undergraduate level, students are provided with a thorough background in the principles of genetics, as well as the application of those principles in fields as diverse as genomics, plant and animal biotechnology, diagnostics and risk determination, bioethics, conservation ecology and population, and behavioural and evolutionary studies.

Graduates acquire skills in analytical and critical thinking, as well as creativity in problem solving and data handling, which equip them for success in both scientific and non-scientific careers.

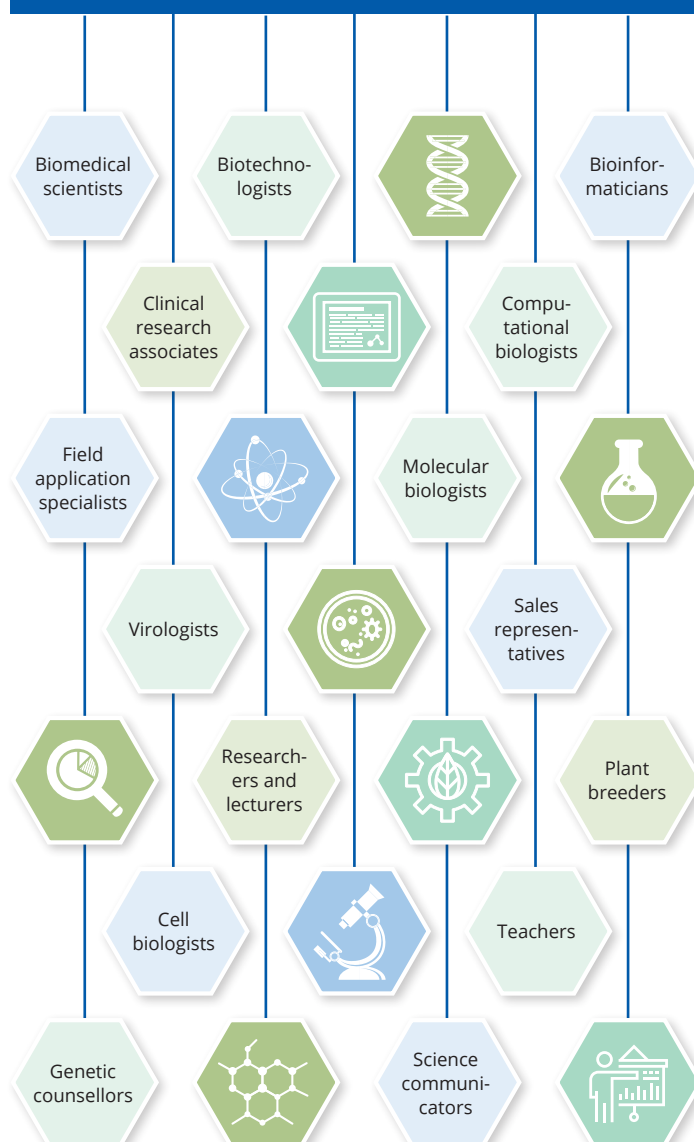
Which companies employ our graduates?

Genetics graduates are employed by institutes such as the CSIR, NHLS, ARC, NRF, SANBI and NICD. Some of the fields in which graduates have been employed are:

- academia;
- plant and crop breeding;
- animal health;
- microbiology;
- virology;
- agriculture and wildlife ;
- medical and pharmaceutical;
- computational biology and bioinformatics;
- biomedical science communication;
- corporate business and sales; and
- human and medical genetics.

What career opportunities exist for graduates?

Employment opportunities are available in various fields and graduates may be employed as:



Biological Sciences

Biochemistry, Genetics and Microbiology

Minimum admission requirements

Programmes	Minimum requirements for NSC and IEB for 2023			
	Achievement level			APS
	English Home Language or English First Additional Language	Mathematics	Physical Sciences	
BSc (Genetics) BSc (Human Genetics) [3 years] Close on availability of space: As soon as the number of places available for this programme are filled, it will be closed for further applications.	5	5	5	32
BSc (Biotechnology) [3 years] Close on availability of space: As soon as the number of places available for this programme are filled, it will be closed for further applications.	5	5	5	32

BSc (Genetics)

Students complete all five of the final year **Genetics** modules together with three modules chosen from either **Biochemistry**, **Plant Science**, **Zoology** or **Microbiology**.

Single Major

Double Major

Genetics modules can be combined with an equivalent number of modules from either **Biochemistry**, **Plant Science**, **Microbiology**, **Zoology** or **Entomology**.

BSc (Human Genetics)

Final year **Genetics** modules can be taken together with a selection of modules from **Human Physiology**, **Biochemistry**, **Pharmacology** or **Microbiology**.

Single Major

Double Major

Genetics modules can be combined with an equivalent number of modules from **Human Physiology**.

BSc (Biotechnology)

Elective modules may be chosen from either **Genetics**, **Biochemistry**, **Plant Science** or **Microbiology**. The choice of modules determine a student's postgraduate outcomes.

BSc (Medical Sciences)

Double Major

Genetics modules can be combined with an equivalent number of modules from **Human Anatomy**.

BSc (Human Physiology, Genetics and Psychology)

Triple Major

Modules from all three fields are taken at final year level. Students may continue with postgraduate studies in **Genetics** by adding one additional final year **Genetics** module.

Postgraduate study options

Additional postgraduate study options available in other Departments and programmes depending on the student's choice of modules at final year level.

Biological Sciences

Biochemistry, Genetics and Microbiology

BSc (Microbiology)

Microbiology is the study of organisms that cannot be seen with the naked eye, such as bacteria, fungi, algae and viruses. Essentially, the microbiology study programme, with its focus on the structure, function and classification of microbial species, is the gateway to the fascinating microbial world.

Students enrolled for this degree will be exposed to a wealth of tools and theoretical information, which can be applied to exploit and control microbial activities for improving industrial and agricultural processes, as well as for improving the lives of animals, humans and plants in the ecosystem.

Who is the ideal candidate?

Aspiring microbiologists should have a solid background in science and are expected to demonstrate curiosity about how biological systems function in their environments. Microbiology overlaps with areas such as botany, chemistry, zoology, physiology, genetics, medicine, nutrition and environmental sciences.

Candidates recognise that the field of microbiology has evolved, and continues to evolve, to cut across scientific disciplines, and understand that microbes impact every aspect of life on earth.

What makes this programme unique?

In microbiology, students learn about the different types of microbes which, even though invisible to the naked eye, represent the most abundant life forms on earth. It is believed that many microbes have not yet been discovered, and others are well adapted to survive in extreme conditions (eg in hydrothermal vents) that resemble conditions believed to have been prevalent when life began on earth billions of years ago. Microbiology is also one of only a few degree programmes that unites a diverse group of individuals (eg immunologists, geneticists, bioinformaticians, computational biologists, environmental scientists, etc) under one umbrella.

What career opportunities exist for graduates?

Since the field of microbiology has many branches, graduates can follow various careers in industry or in academia, where they can contribute to increasing scientific knowledge, or they can establish their own businesses.

Which companies employ our graduates?

Graduates with microbiology degrees are employed by leading research institutes in South Africa, including the CSIR, ARC, FABI, NICD, SASRI, MRC and NRF, and by biotech industries such as Inqaba Biotech, CapeBio, Akili Labs and BioTech Africa. Generally they are employed as:

- Managers (eg Land remediation/ Laboratory manager)
- Food technologists
- Laboratory technicians
- Quality assurance specialists
- Plant pathologists
- Medical/Clinical microbiologists
- Biomedical scientists
- Bioinformaticians
- Agricultural scientists
- Scientific writers

Minimum admission requirements

Programme	Minimum requirements for NSC and IEB for 2023			
	Achievement level			APS
	English Home Language or English First Additional Language	Mathematics	Physical Sciences	
BSc (Microbiology) [3 years] Close on availability of space: As soon as the number of places available for this programme are filled, it will be closed for further applications.	5	5	5	32

Biological Sciences

Human Physiology

BSc (Human Physiology)

During the first year of study for this degree, students are exposed to a generic range of subjects from the biological and agricultural sciences. In the second year they study physiological systems, which include the neurophysiological, haematological, cardiovascular, pulmonary, renal, nutritional and digestive, endocrinological and reproductive systems), with biochemistry as a compulsory subject.

The study programme for the third and final year includes a selection of integrated physiology modules, such as exercise and nutrition physiology, cellular and developmental physiology, applied and pathophysiology, higher neurological function and industrial physiology. At the third-year level, students have an opportunity to select elective modules in the programme. The BSc (Human Physiology) programme will appeal to scientifically minded students who are inquisitive by nature.

What makes this programme unique?

Physiologists study the mechanisms by which the body functions from the molecular and cellular levels through progressive differentiation to tissue, organs and systems, and eventually the integrated interactions and control of body functions.

This core knowledge is applied in research undertaken to investigate normal and abnormal life processes.

What career opportunities exist for graduates?

Research is undertaken in cooperation with medical teams in private and government research laboratories at, for example, the Council for Scientific and Industrial Research (CSIR), the Medical Research Council (MRC), the South African Bureau of Standards (SABS), pharmaceutical firms, universities, veterinary and industrial institutions, state departments (for example the Department of Health) and health farms.

Physiologists also make contributions in the fields of education (as teachers, lecturers and instructors), sports physiology, biostatistics, bioengineering, industrial hygiene, journalism, medical technology and, in the industry, as representatives of pharmaceutical firms.

Which companies employ our graduates?

Our graduates are employed by:

- Academia
- State departments (eg the Department of Health)
- Medical and pharmaceutical companies
- Private and government research laboratories (CSIR, MRC, NHLS, ARC, NRF, SANBI and NICD)
- Computational biology and bioinformatics companies
- Biomedical science communication companies
- Corporate and sales businesses
- Wellness companies



Minimum admission requirements

Programme	Minimum requirements for NSC and IEB for 2023			
	Achievement level			APS
	English Home Language or English First Additional Language	Mathematics	Physical Sciences	
BSc (Human Physiology) [3 years] Close on availability of space: As soon as the number of places available for this programme are filled, it will be closed for further applications.	5	5	5	32

Biological Sciences

Human Physiology

BSc (Human Physiology, Genetics and Psychology)

During the first two years of study, students are exposed to fundamental core scientific and biology-related modules. Final-year studies include modules from all three disciplines (Physiology, Genetics and Psychology), thus creating opportunities to continue with postgraduate studies in any of the three disciplines. The BSc (Human Physiology, Genetics and Psychology) programme is recommended for individuals with a passion for biological and related sciences who wish to gain core knowledge in these fields.

What career opportunities exist for graduates?

Many of the career options are research oriented. Research is conducted in cooperation with medical teams at private and government research laboratories, pharmaceutical firms, universities, veterinary and industrial institutions. Further study can lead to careers in genetic counselling and psychology.

Graduates who have obtained this degree are also employed in the fields of:



What makes this programme unique?

The structuring of the programme, which allows students to choose any one of three majors for postgraduate studies, is quite unique. Another notable feature is the transdisciplinary inclusion of Psychology as a humanities module, which offers additional opportunities.

Which companies employ our graduates?

Our graduates are employed by:

- Academia
- State departments (eg the Department of Health)
- Medical and pharmaceutical companies
- Private and government research laboratories (CSIR, MRC, NHLS, ARC, NRF, SANBI and NICD)
- Veterinary and industrial institutions
- Computational biology and bioinformatics companies
- Biomedical science communication companies
- Corporate and sales businesses
- Wellness companies
- Human and medical genetics laboratories

Minimum admission requirements

Programme	Minimum requirements for NSC and IEB for 2023			
	Achievement level			APS
	English Home Language or English First Additional Language	Mathematics	Physical Sciences	
BSc (Human Physiology, Genetics and Psychology) [3 years] Close on availability of space: As soon as the number of places available for this programme are filled, it will be closed for further applications.	5	5	5	32

Biological Sciences

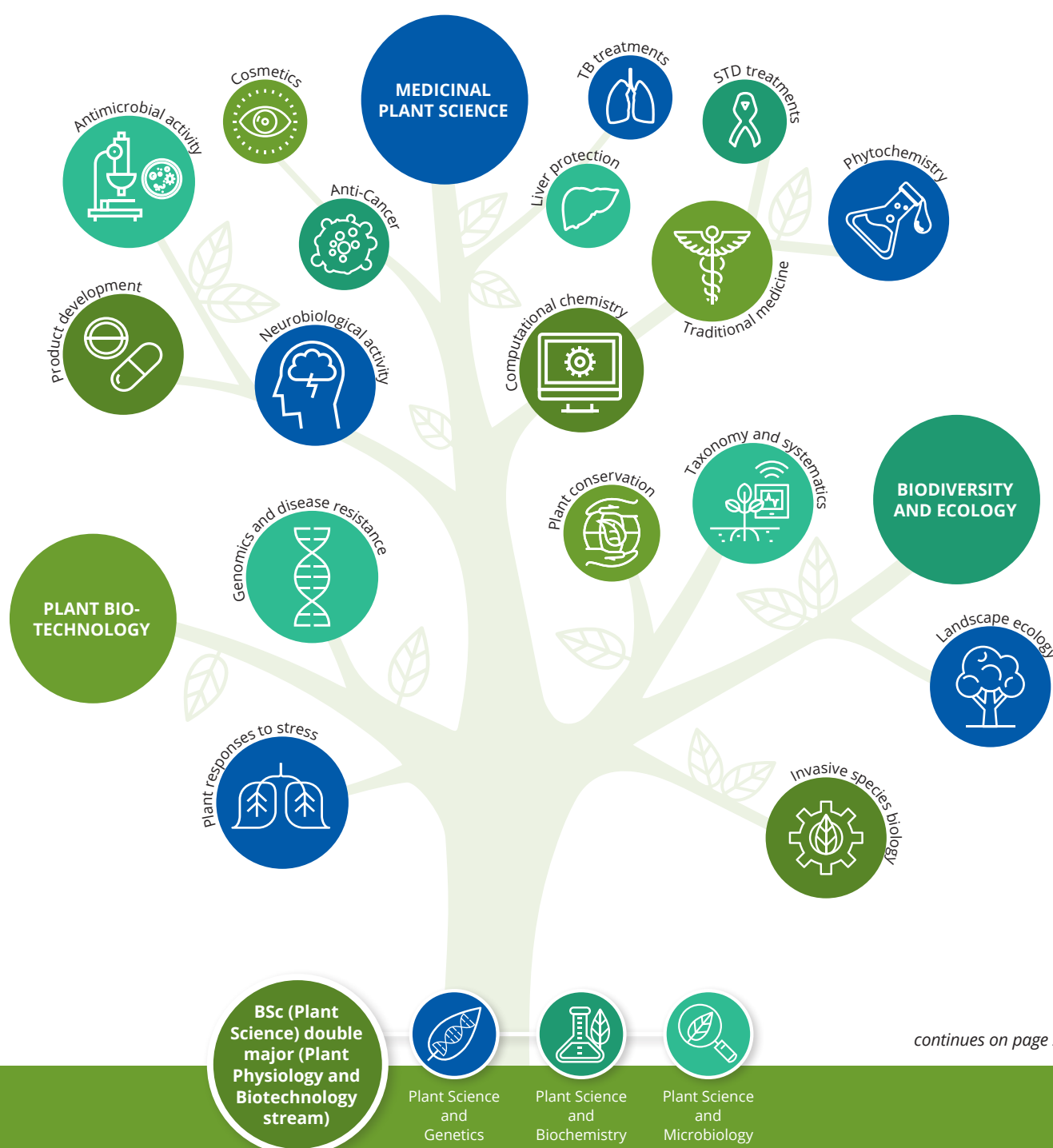
Plant and Soil Sciences

BSc (Plant Science)

Although plants are amazing organisms, we actually know very little about their potential uses. It is, however, well known that plants are the best factories for synthesising valuable natural products.

A degree in plant sciences is a three-year degree that broadly covers all relevant aspects of plant sciences. Further studies allow students to specialise in medicinal plant science, plant biotechnology or ecology and biodiversity.

In medicinal plant sciences, students learn about the discovery and use of plant medicines and phytotherapeutically important molecules obtained from plants. Students studying Plant Biotechnology learn about molecular tools and the use of model plants to study plant physiology. In the study of plant diversity and ecology, students learn about South Africa's rich and diverse vegetation and its origin, and how to facilitate conservation and management strategies for future generations.



continues on page 21

Biological Sciences

Plant and Soil Sciences

BSc (Plant Science) (continued)

Who is the ideal candidate?

The ideal candidate is someone who is inquisitive, has a broad interest in plants and the environment, conservation and in improving wellness and quality of life.

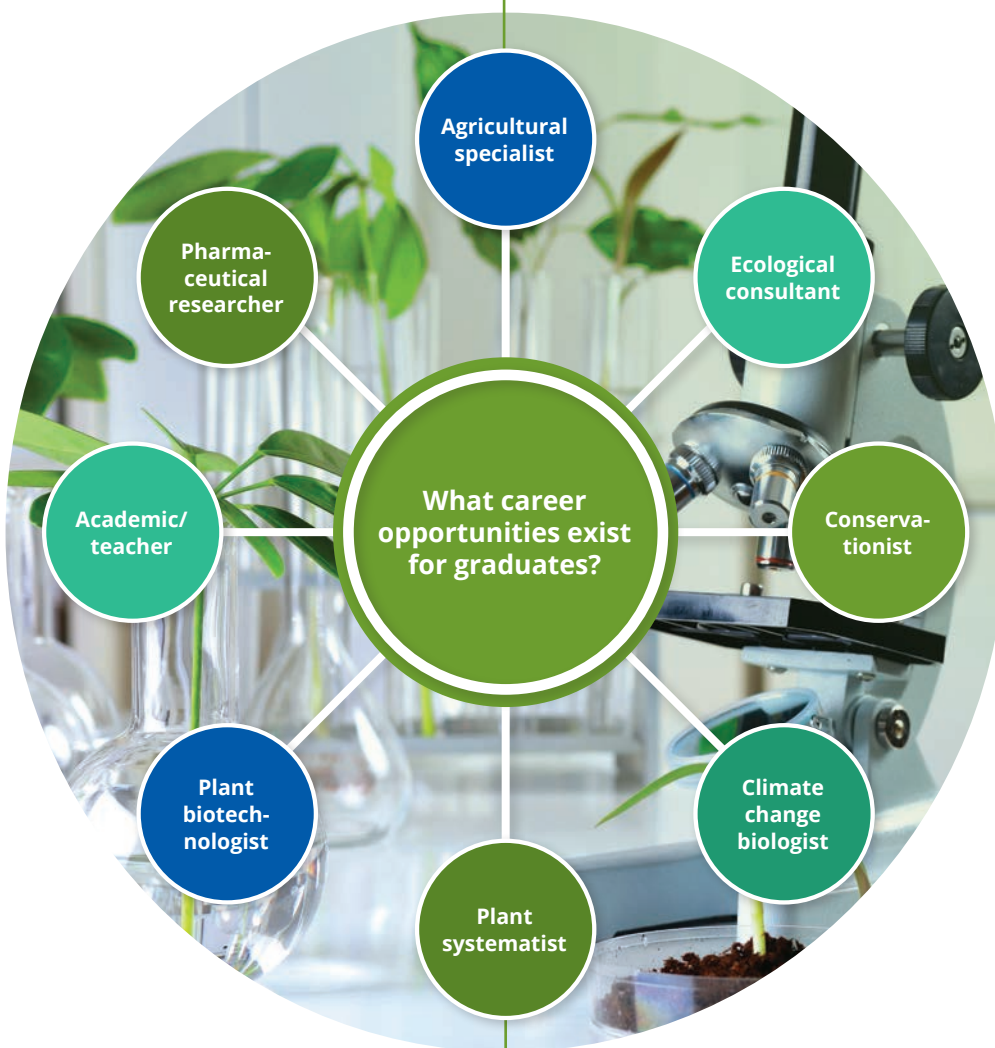
What makes this programme unique?

The Department is dynamic, innovative, modern and relevant. Staff members undertake world-class research and 70% have received NRF ratings.

Much of the research (including soil science) is of an applied nature and contributes to the improvement of agricultural crops and methods, knowledge of plant diseases, the use of plant-derived compounds, biodiversity (including evolutionary systematics and ecology) and plant biotechnology.

Which companies employ our graduates?

- Our graduates are employed at:
- Medical Research Council (MRC)
 - The Council for Scientific and Industrial Research (CSIR)
 - The South African National Biodiversity Institute (SANBI)
 - Pharmaceutical industries
 - Tertiary institutions
 - Government departments



Minimum admission requirements

Programme	Minimum requirements for NSC and IEB for 2023			
	Achievement level			APS
	English Home Language or English First Additional Language	Mathematics	Physical Sciences	
BSc (Plant Science) [3 years] Close on availability of space: As soon as the number of places available for this programme are filled, it will be closed for further applications.	5	5	5	32

Biological Sciences

Zoology and Entomology

BSc (Ecology)

The BSc (Ecology) programme explores how animals and plants interact with each other and the natural environment. It will allow you to contribute to their conservation and solve the challenges threatening life on Earth. If you want to pursue a career in biodiversity conservation, environmental consultancy, land rehabilitation or wildlife management, this programme is for you.

What makes this programme unique?

BSc (Ecology) is the only programme of its kind offered in South Africa and teaching is focused on animals and plants, ecology, geographic information systems and quantitative statistics.

What career opportunities exist for graduates?

As a graduate you can find employment as a conservation officer, environmental consultant or manager, game ranger, research scientist and more.

Which companies employ our graduates?

You can find employment at government agencies concerned with the environment, conservation organisations, state or private game reserves, environmental consultancies and education initiatives, academic and training institutions and many more.



Minimum admission requirements

Programme	Minimum requirements for NSC and IEB for 2023			
	Achievement level			APS
	English Home Language or English First Additional Language	Mathematics	Physical Sciences	
BSc (Ecology) [3 years] Close on availability of space: As soon as the number of places available for this programme are filled, it will be closed for further applications.	5	5	5	32

Biological Sciences

Zoology and Entomology

BSc (Entomology)

The BSc (Entomology) programme gives exciting insights into insect diversity, conservation, ecology and physiology. As a graduate you can help to protect our crops, livestock, human health and the environment. This programme is right for you if you want a career in forensics, environmental affairs, or plant, animal or public health.

What makes this programme unique?

All of our lecturers are leaders in their fields. They have strong ties to governments, local and international organisations, and industries. This unlocks employment and postgraduate opportunities.

What career opportunities exist for graduates?

Graduates find employment as biological control researchers, entomological collections curators, environmental consultants and managers, forensic entomologists, insect pest management specialists, insect-rearing and laboratory technicians, quarantine officers, public health practitioners, and many more.

Which companies employ our graduates?

Graduates are employed by government and international agencies, agricultural industries and research institutes, environmental consultancies, nature conservation agencies, museums, the South African Police Service, and public health research and policy institutes.

PROTECT OUR FOOD SUPPLY

Entomologists work with farmers to protect our crops from pest insects. They study pollinators so there is always fruit and vegetables on supermarket shelves.

BENEFIT TO YOU

Fresh foods, grains and juices stay plentiful and affordable.



PROTECT HUMANS AND ANIMALS

Entomologists help to reduce the number of biting insects. This keeps them from harming you, your pets and livestock.

BENEFIT TO YOU

Affordable meat and dairy products.
Lower risk of disease.



What can an ENTOMOLOGIST do for you?

An entomologist is a scientist who studies or works with insects and related animals. With more species of insects on Earth than any other group of organisms, the work of entomologists is vitally important and affects us all.



CONSERVE OUR FORESTS

Entomologists study how some insects benefit forests by aiding in decomposition and others harm forests by killing trees.

BENEFIT TO YOU

Healthy forests clean our air, cool the planet, produce lumber and paper, and provide habitat for plant and animal species.

DEFEND YOUR HOME

Entomologists advise pest management pros on how to safely prevent and remove indoor pests such as cockroaches, bed bugs, flies, and ants.

BENEFIT TO YOU

A clean, pest-free living space—plus, reduced damage to homes and buildings, and increased property values.

Minimum admission requirements

Infographic text sourced and adapted from www.entsoc.org

Programme	Minimum requirements for NSC and IEB for 2023			
	Achievement level			APS
	English Home Language or English First Additional Language	Mathematics	Physical Sciences	
BSc (Entomology) [3 years] Close on availability of space: As soon as the number of places available for this programme are filled, it will be closed for further applications.	5	5	5	32

Biological Sciences

Zoology and Entomology

BSc (Zoology)

Zoology is the scientific study of animal life. In the BSc (Zoology) programme you will gain the knowledge and skills needed to understand, protect and manage the diversity of wild African animals. This will involve training in animal evolution and diversity, physiology, behaviour and ecology, as well as related scientific fields.

Who is the ideal candidate?

The BSc (Zoology) is the ideal programme if you want to know how animals interact with each other, sense and respond to their surroundings, can be harvested sustainably and can be protected against human threats.

What makes this programme unique?

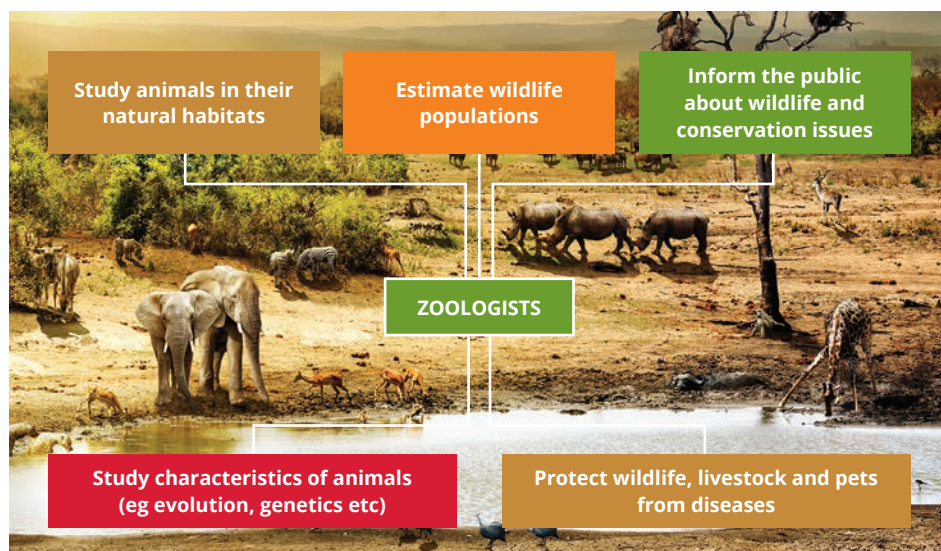
The University of Pretoria is the top-ranked institution in Africa for the subject of Zoology and is home to the internationally renowned Mammal Research Institute.

What career opportunities exist for graduates?

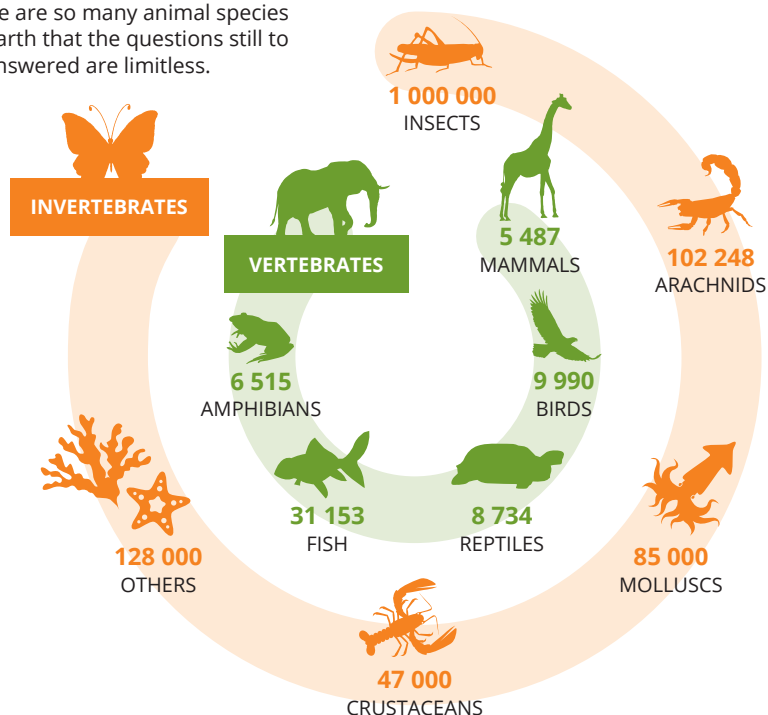
This degree can lead to a career as a wildlife or marine biologist, biology teacher, conservation officer, animal welfare officer, environmental consultant or manager, zoo or aquarium curator, museum collection curator, game ranger, epidemiologist and researcher, among others.

Which companies employ our graduates?

National, provincial and local governments, international and private conservation organisations, zoos and aquariums, museums, environmental consultancies, environmental education initiatives, academic and training institutions, and many more.



There are so many animal species on Earth that the questions still to be answered are limitless.



Infographic adapted from The Brazilian Biodiversity Information System

Minimum admission requirements

Programme	Minimum requirements for NSC and IEB for 2023			
	Achievement level			APS
	English Home Language or English First Additional Language	Mathematics	Physical Sciences	
BSc (Zoology) [3 years] Close on availability of space: As soon as the number of places available for this programme are filled, it will be closed for further applications.	5	5	5	32

Agricultural and Food Sciences

Agricultural Economics, Extension and Rural Development

BScAgric (Agricultural Economics and Agribusiness Management)

The BScAgric (Agricultural Economics and Agribusiness Management) programme provides students with an overview of the global food and agricultural sector and teaches them vital skills in business and science. These skills enable them to build careers in food and agricultural value chains, from seed to plate, and everything in between.



Who is the ideal candidate?

The BScAgric (Agricultural Economics and Agribusiness Management) programme is ideal for students who have competencies in science and business subjects and are passionate about these fields.

What makes this programme unique?

The programme develops problem solvers with unique skill sets who contribute to feeding and clothing the world.

Which companies employ our graduates?

Companies, where our alumni are employed, include; commercial banks (eg ABSA, FNB, Landbank, Nedbank, and Standard Bank), insurance companies (Santam), agricultural input providers (Syngenta, Omnia, and John Deere), agricultural service providers (Afgri, NWK, TWK and VKB), agricultural producers organisations (AgriSA, Agri WC, GrainSA, Potato SA, SAPPO and VinPro), agricultural associations (Agbiz), grain trading companies (Majesty Oil, Louis Dreyfus Company and Grainvest), investment groups (Russell Stone Group), food manufacturers (Tiger Brands), government departments (Department of Agriculture, Land Reform and Rural Development and Department of Environment, Forestry and Fisheries), research institutes (Agricultural Research Council and Bureau for Food and Agricultural Policy), and international bodies (Food and Agriculture Organization and World Bank) to name a few.



'If you want to do more than study the theory and instead learn how to make money, Agricultural Economics is the degree for you. With the real-life economic skills learnt in this programme, you can be an asset to any company; and help solve their problems.'

This degree also teaches you how to trade on SAFEX, which allows you to become a registered broker on the JSE. Having this skill is valuable to any agribusiness and if your future is on the farm, it allows you to sell your produce at the highest prices.'

– **Oliver Eggers (final-year student)**



'My postgraduate studies take a multidimensional approach to policy economics and aims to determine how we can maintain and assure the global supply and flow of food, especially in the difficult times we are facing. We balance science and numbers and use the results to inform policy changes to establish sustainable and resilient agricultural supply chains to feed nations.'

– **Dipuo Boshomane (postgraduate student)**



'People will always be hungry; therefore there will always be a need for agriculture. Agriculture is the foundation of economics, trade, capital and finances. If you want to know what the whole world revolves around, study Agricultural Economics. You won't regret it!'

– **Adelene van Zyl (final-year student)**



'As a foodie, my degree has made me more appreciative of food and where it comes from. We have a wide variety of food on this continent, and thanks to global food supply chains, we all have unlimited opportunities for experiencing the world of food. It gives me joy and a sense of fulfilment to know that through my studies, I am part of solving the problem of feeding the world.'

– **Chikomborero Chiobvu (postgraduate student)**

Minimum admission requirements

Programme	Minimum requirements for NSC and IEB for 2023			
	Achievement level			APS
	English Home Language or English First Additional Language	Mathematics	Physical Sciences	
BScAgric (Agricultural Economics and Agribusiness Management) [4 years] Close on availability of space: As soon as the number of places available for this programme are filled, it will be closed for further applications.	5	5	5	32

Agricultural and Food Sciences

Agricultural Economics, Extension and Rural Development

What career opportunities exist for graduates?

Employment opportunities for agricultural economists exist in, for example, the government, commercial banks, multinational agribusiness companies, agribusinesses, commodity trading houses, food processors and manufacturers, and research councils. The work done by our agricultural economists includes:

Training of smallholder farmers by providing extension services

Advising the government on how to ensure that there will be enough food for all South Africans

Trading of financial instruments and agricultural commodities on global and local stock markets

Conducting research in environmental economics to assist the efforts of governments and businesses to ensure the sustainable use of scarce resources such as water

Managing various aspects of agribusinesses, food companies and food supply chains

Analysing and understanding consumer behaviour in terms of people's wants, needs and willingness to pay for food and clothing

Advising clients in the agricultural sector on how to manage their finances and risks

Conducting research to ensure the sustainable and profitable supply of food and clothing across the various supply chains

Agricultural and Food Sciences

Animal Science

BScAgric (Animal Science)

Livestock, pig and poultry production is one of the major sectors in South African agriculture and contributes substantially to the economy of the country. Animal Science is the science of livestock production, with a focus on animal breeding and genetics, animal nutrition, and production animal physiology (growth and reproduction physiology). Animal science covers all aspects of animal production and animal welfare in intensive and extensive production systems. This includes the husbandry of several livestock species (cattle, sheep, goats, pigs, poultry, ostriches and horses), and the products derived from them (meat, milk and dairy products, wool, mohair, eggs, skins, leather and feathers). It also includes the nutrition and breeding of companion animals.

Who is the ideal candidate?

The ideal candidate is someone who has a passion for science and working with livestock, game and companion animals, as well as those interested in sustainable animal production for food and profit.

What makes this programme unique?

BScAgric (Animal Science) graduates can register as professional animal scientists and make a meaningful contribution to improve animal husbandry practices and sustainable food production for profit.

Which companies employ our graduates?

Our graduates are employed by:

- Animal feed companies and feed mills
- Pharmaceutical companies,
- Agricultural Research Council,
- Universities and Universities of Technology
- Private consultants
- Agricultural co-operations
- Semen and embryo collection and artificial insemination companies
- Breeders' societies
- SA Studbook
- Nature reserves and game farms
- NGOs and Department of Agriculture

What career opportunities exist for graduates?

Depending on the level of specialisation in animal science, employment opportunities may be found in the following fields:

- Agricultural development institutions (eg NGOs, Department of Agriculture)
- Animal husbandry industry (eg feed companies, small or large livestock production systems ranging from small farms to large systems like feedlots or abattoirs, and animal breeding companies, animal breed societies, or in the corporate sector)
- Animal products industry (eg dairy and poultry products)
- Breeding organisations (eg breeders' societies, SA Studbook)
- Consultancy and advisory services (eg private consultant, agricultural co-operations)
- Educational institutions (eg universities, technical colleges)
- Feed industry (eg animal feed production companies)
- Legislative/regulative institutions (eg Department of Agriculture)
- Nature conservation institutions (eg nature reserves, game farms)
- Pharmaceutical industry (eg pharmaceutical companies)
- Research institutions (eg the Agricultural Research Council)
- Semen and embryo collection and artificial insemination companies



Minimum admission requirements

Programme	Minimum requirements for NSC and IEB for 2023			
	Achievement level			APS
	English Home Language or English First Additional Language	Mathematics	Physical Sciences	
BScAgric (Animal Science) [4 years] Close on availability of space: As soon as the number of places available for this programme are filled, it will be closed for further applications.	5	5	5	32

Agricultural and Food Sciences

Consumer and Food Sciences

BSc (Culinary Science)

Culinary science is a broad-based discipline that combines food chemistry, microbiology, culinary art and food product development, and lends itself to innovation and entrepreneurship. The practical training includes the characterisation of various food ingredients and their utilisation in recipe development. The research component focuses on understanding the functional properties of various food types and their application in the food service industry.

This degree is for those who are not only interested in creating food that tastes and looks great, but also want to understand why food tastes and looks the way it does.

Any candidate wishing to pursue a career in the culinary science stream requires not only technical ability, but also has to be an analytical problem solver who pays attention to detail.

What makes this programme unique?

This degree offers a seamless integration of culinary art and science to equip future graduates with a degree embedded in science and technology and tailored to changing culinary trends.

Which companies employ our graduates?

Research institutions, food processing companies (McCain, Enterprise, BRM Foods, Mondelez), flavour houses (McComick, Firmenich), the food service industry (Famous Brands), Leading retailers (Woolworths, Pick n Pay, Checkers), government institutions and various institutions of higher learning.

What career opportunities exist for graduates?

Culinary scientists, culinologists, sensory analysts, food researchers, food product developers, food service managers, safety and quality assurers, food production managers, entrepreneurs and food legislation experts.

'I was very excited when I heard about the BSc (Culinary Science) programme. I enrolled because it offers a perfect mix between food and science, which are two of my major passions. I really enjoy my course because it includes cooking and recipe development, but does not neglect the science behind what happens to the food on the molecular level. The BSc (Culinary Science) degree opens the door to many careers in the food industry, but my dream job is to be a flavour scientist.'

– **Danae Bezuidenhout: BSc (Culinary Science) graduate**

'This degree combines the creativity of culinary arts with the rationality of food science and through my studies I have obtained a unique scientific view of food service management. Over the past four years I have realised the importance of consumer satisfaction to both food service managers and food technologists. I believe that my degree will open many doors for me in the future, notably in my main field of interest, which is recipe development. I enjoy applying my specific scientific knowledge while experimenting with food.'

– **Christine Janik: BSc (Culinary Science) graduate**

Minimum admission requirements

Programme	Minimum requirements for NSC and IEB for 2023			
	Achievement level			APS
	English Home Language or English First Additional Language	Mathematics	Physical Sciences	
BSc (Culinary Science) [4 years] Close on availability of space: As soon as the number of places available for this programme are filled, it will be closed for further applications.	5	5	5	32

Agricultural and Food Sciences

Consumer and Food Sciences

BSc (Food Science)

This programme focuses on the chemical composition, structure and nutritional value of food. The interaction of food components during processing, preservation and storage is studied by making use of chemistry, physics, biological and mathematical principles. Candidates who are likely to excel are those who enjoy science and are keen on understanding food production from farm to fork.

What makes this programme unique?

Candidates study a product that is used daily by all people and therefore prepare themselves to play a role in feeding the nation. A graduate with a BSc (Food Science) degree is eligible for registration as a natural scientist with the South African Council of Natural Scientific Professions (SACNASP).

Which companies employ our graduates?

Our graduates are employed by all major food production companies eg Nestlé, RCL Foods, In2Foods, Unilever and the Rhodes Food Group; by major food retailers eg Shoprite and Checkers, Woolworths, Pick n Pay; by flavour and additive producing companies eg SAAFI and Cell-Chem; and laboratories that specialise in analysing food in South Africa and all over the world.

What career opportunities exist for graduates?

Food risk investigators

Food and nutrition analysts

Safety auditors

Product and process development managers

Quality and safety assurance managers

Food structure designers

Food chemists

Technical sales and marketing advisors

Brewers

Sensory scientists

Packaging and shelf-life specialists

Food microbiologists

Programme

BSc (Food Science)

[3 years]

Close on availability of space:

As soon as the number of places available for this programme are filled, it will be closed for further applications.

Minimum requirements for NSC and IEB for 2023

Achievement level

Programme	Achievement level			APS
	English Home Language or English First Additional Language	Mathematics	Physical Sciences	
BSc (Food Science)	5	5	5	32

Agricultural and Food Sciences

Consumer and Food Sciences

BSc (Nutrition)

The BSc (Nutrition) programme involves the study of concepts from various disciplines, including food chemistry and food composition, biochemistry, physiology and human nutrition. An ideal candidate is someone who has analytical skills and a keen interest in the science of food and nutrition.

What makes this programme unique?

This is an interfaculty programme presented jointly by the Departments of Consumer and Food Sciences (Natural and Agricultural Sciences) and Human Nutrition (Health Sciences).

BSc (Nutrition) graduates will become nutritional scientists eligible for registration as natural scientists with the South African Council for Natural Scientific Professions and the Nutrition Society of South Africa.

What career opportunities exist for graduates?

A varied field with numerous career opportunities, which include:

- Food product and supplement development to meet specific nutritional needs of the consumer
- Project management and implementation of food programmes and legislation for government departments, international organisations and NGOs
- Entrepreneurship and small business development
- Nutrition research in the food industry or research institutes



'I have found the four-year BSc (Nutrition) degree course to be very interesting as it consists of a variety of modules that cover topics ranging from human physiology to food sciences. Being taught by the experts in the department has really made studying very enjoyable. This degree caters perfectly for my two passions, which are science and helping others. I dream of becoming a policy developer and making a contribution towards ending hunger.'

– **Natasha Howes**



'My journey as a BSc (Nutrition) student has exceeded all my expectations. The workload is intense, which forced me to grow personally and perform academically. Our exposure to different science disciplines broadens our understanding of the world of science and helps us to incorporate the role of a nutritional scientist with the roles of scientists in other disciplines. My dream is to partner with major organisations to help reduce nutrition-related diseases and teach people how to maintain good health affordably.'

– **Ntšepase Princess Matete**

Minimum admission requirements

Programme	Minimum requirements for NSC and IEB for 2023			
	Achievement level			APS
	English Home Language or English First Additional Language	Mathematics	Physical Sciences	
BSc (Nutrition) [4 years] Close on availability of space: As soon as the number of places available for this programme are filled, it will be closed for further applications.	5	5	5	32
BSc (Nutrition) is an interfaculty degree programme, presented jointly by Consumer and Food Sciences (Faculty of Natural and Agricultural Sciences) and Human Nutrition (Faculty of Health Sciences).				

Agricultural and Food Sciences

Consumer and Food Sciences

BConSci (Clothing: Retail Management)

Clothing Retail Management combines clothing construction, design, fashion, textiles, consumer behaviour, and retail and merchandising subjects with various marketing and business modules to prepare students for the exciting and ever-changing textile and clothing industry. Candidates who excel in this programme are those who are both creative and analytical, and can function well under pressure and in team-oriented environments.

What makes this programme unique?

This is a vocational programme that balances theory, practical application, and experiential training in the industry. Through the programme students are exposed to the entire clothing supply chain and can specialise in a particular area of interest once they graduate.

Graduates are well-trained and ready to venture into the many different areas offered in the textile and clothing industry.

What career opportunities exist for graduates?

Graduates are typically employed as clothing buyers and planners, allocation planners, brand managers, product developers, fashion designers, fashion marketers, social media content managers, quality assurance managers, sourcing coordinators, textile technologists, visual merchandisers, and pattern technologists or can become entrepreneurs.

Which companies employ our graduates?

All the major clothing retailers in South Africa (eg. Mr Price (MRP), Truworths, TFG group, Pep, Woolworths, Cape Union Mart) and various brands (eg. Lacoste, Guess) employ our graduates.

Students are also appointed as merchandisers, account managers, or production coordinators at suppliers, production companies, and licensing companies (eg. Blue Horizon for Mattel, Character group, Cosmic Options).



'I thoroughly enjoyed this degree programme as it combines my two passions, namely fashion and business, and develops the students' creative and analytical abilities to achieve all-round excellence.

I appreciated the focus on sustainability, especially in the final year, which provides the tools needed to have a positive environmental impact in the clothing and textile industry. I dream of becoming a sustainable fashion planner/buyer.'

– Shanna Howarth: BConSci (Clothing: Retail Management) graduate 2020



'I have always dreamed of working in the fashion industry, specifically as a buyer. This degree opens the doors to all sections of this industry. Unlike many other degrees, it has the ability to develop and test both the creative and business sides of the brain and prepare students of all personality types for any aspect of the fashion industry.'

– Tannah Metzler: BConSci (Clothing: Retail Management) graduate 2020

Minimum admission requirements

Programme	Minimum requirements for NSC and IEB for 2023		
	Achievement level		APS
	English Home Language or English First Additional Language	Mathematics	
BConSci (Clothing: Retail Management) [4 years] Close on availability of space: As soon as the number of places available for this programme are filled, it will be closed for further applications.	5	4	28

Agricultural and Food Sciences

Consumer and Food Sciences

BConSci (Food: Retail Management)

Food retail management covers the entire food supply chain in one programme—from farm to fork. The food retail programme focuses on incorporating not only the fundamentals of food preparation, food service management, nutrition, food safety and hygiene, but also recipe development and standardisation, consumer aspects of foods and sustainable food retail logistics. Emphasis is placed on future retail trends, such as omni-channel retailing, blockchain and the creation of immersive customer experiences. The programme also includes various marketing and business modules. In order to fit into the dynamic world of retailing, candidates need to be inquisitive, confident team players with good numerical and organisational skills and a degree of commercial awareness.

What makes this programme unique?

Students are exposed to every aspect of the food retail industry through on-site visits and exposure to guest speakers from local and international industries. Students are also required to complete experiential training/internships.

What career opportunities exist for graduates?

Food retail graduates pursue managerial positions as brand or sales managers, store managers, food and beverage buyers and planners, food stylists, food product marketers, food product category managers, quality assurance managers, visual merchandisers, consumer insight specialists and entrepreneurs.

Which companies employ our graduates?

All key South African retailers (Woolworths, Shoprite – Checkers, Spar, PnP, Dischem), related subsidiary companies and/or other supply chain stakeholders (such as Freshmark, RCL, In2Food, SABMiller, DotActiv, RSA Market Agent). Graduates have also been employed by various consumer research companies, such as Consulta and Ask-Africa.



'The wealth of knowledge that I gained throughout my four years of study has taught me everything from economics all the way through to consumer behaviour and sustainability in the retail environment. This degree has helped me to put my passion for sustainability into practise. We live in a time when it is simply unacceptable not to think about the impact that you have on the earth. That is why I would like to become a chief sustainability officer at a major retailer.'

– **Daniella Klut: BConSci (Food: Retail Management) graduate 2020**



'This programme has given me valuable insight into various disciplines and has taught me how to work well with a diverse group of people. I learnt that consumer science is not only relevant, but is central to the well-being and sustainability of our society. I dream of becoming a consumer insights specialist.'

– **Kathryn Geldenhuys: BConSci (Food: Retail Management) graduate 2020**

Minimum admission requirements

Programme	Minimum requirements for NSC and IEB for 2023		
	Achievement level		APS
	English Home Language or English First Additional Language	Mathematics	
BConSci (Food: Retail Management) [4 years] Close on availability of space: As soon as the number of places available for this programme are filled, it will be closed for further applications.	5	4	28

Agricultural and Food Sciences

Consumer and Food Sciences

BConSci (Hospitality Management)

Hospitality management seeks to prepare students for employment with leading food companies, master chefs working in top kitchens and other experts in the food and hospitality industry. Graduates will not only learn to create exceptional dishes, but will also be involved in culinary art, food product development, recipe development, food styling, large-scale food production, restaurant management and events management. Various marketing and business modules are also included in the programme. To fit into the vibrant, innovative and creative hospitality world, candidates must be team players who are curious by nature and service oriented, and have a passion for food and the hospitality industry. If you have boundless patience, perseverance and creativity, this degree is perfect for you.

What makes this programme unique?

Students are introduced to every aspect of the hospitality and tourism industries through hands-on training and site visits, and are exposed to guest speakers from local and international industries. They are also required to complete experiential training/internships, which allow them the opportunity to familiarise themselves with the workplace and gain first-hand experience of the real-world hospitality industry.

This degree is unique as it combines science, creativity, art and business management practices to create a practical hands-on experience that provides students with many possible work opportunities to choose from after graduating. In South Africa, this programme is one of only a few hospitality degrees that is still being offered in a traditional university setting.



Which companies employ our graduates?

Graduates who completed the degree have been employed in the following fields, among others:

- Hotel and tourism management
- Small business enterprises and recipe/product development
- Consumer research and food journalism
- Academia and teaching



What career opportunities exist for graduates?

Hospitality Management graduates pursue managerial positions such as accommodation managers, catering managers, conference centre managers, events managers, hotel managers, fast food managers, game and lodge managers, restaurant managers (both back- and front-of-house) and public house managers.

This degree also opens up many work opportunities in the culinary world, including chef, food stylist, food photographer, sommelier, menu engineer, recipe and product developer, product marketer, food safety consultant, improvement specialist, culinary idea conceptualisation specialist and entrepreneur. Many graduates also choose to become academics or teachers.



'This amazing degree programme not only taught me a lot about food and cooking, but also about conducting business. I chose this degree as it qualifies students for just about any position in the hospitality industry. I have learnt how to manage a business, I know what consumers want and I have food preparation experience. My dream job is to own and manage my own wedding/events venue and this qualification will help to make my dream come true.'

– **Melissa Fourie: BConSci (Hospitality Management) graduate 2020**



'The extensive and in-depth nature of this four-year degree in Consumer Science Hospitality Management has ensured that I have a strong business, entrepreneurial and culinary background, which will stand me in good stead in my future endeavours in the hospitality sector. My years as a student at UP have enabled me to grow as an individual, broaden my knowledge and develop a genuine appreciation of the industry. The opportunities I have been given and the skills that I acquired will enable me to pursue a future in food media and photography.'

– **Taylen Kench: BConSci (Hospitality Management) graduate 2020**

Minimum admission requirements

Programme	Minimum requirements for NSC and IEB for 2023		
	Achievement level		APS
	English Home Language or English First Additional Language	Mathematics	
BConSci (Hospitality Management) [4 years] Close on availability of space: As soon as the number of places available for this programme are filled, it will be closed for further applications.	5	4	28

Agricultural and Food Sciences

Plant and Soil Sciences

BScAgric (Plant Pathology)

The BScAgric (Plant Pathology) programme entails the study and control of plant diseases.

The ideal candidate is a creative thinker who wants to explore and understand problems, why and how they arose, and to find solutions. Finding the culprit (ie the pathogen) that caused disease or even death (of plants) is very much like being a detective working at a crime scene to figure out what happened. Like veterinary scientists and medical doctors, plant pathologists also work with patients but with the difference that they cannot communicate with the plant. They therefore have to rely on observation, experience and intuitive knowledge to figure out what is wrong and to find a solution.

A student who does well in this programme is often one who is curious, creative, passionate, driven and ambitious, wanting to explore new challenges.

Agricultural scientists often work in the field or in plant nurseries, farms, pack houses, processing plants, markets or retail. They may also be involved in the local or international food trade. They are multifaceted thinkers who enjoy solving problems, are curious about nature and want to provide food for the table by ensuring healthy plants, crop protection, high yields and reduced waste and losses.

What makes this programme unique?

The programme covers both basic and applied research and ensures safe food and food security for all.

Which companies employ our graduates?

Our graduates are employed at:

- National Department of Agriculture
- Agricultural Research Council
- Agrochemical companies
- Seed and plant production companies
- Undercover crop production endeavours, eg vertical farming, greenhouses and hydroponics
- Tissue culture laboratories
- Diagnostic laboratories
- Biological control companies
- Nurseries and garden centres
- Lawn and landscape maintenance firms
- Agricultural cooperatives
- Private agricultural estates, farms and big corporate estates
- The SA Bureau of Standards (SABS) and Council for Scientific and Industrial Research (CSIR)
- Exporting or importing companies
- Fresh Produce Markets and Retailers
- National and International certification bodies such as auditors, assessors or technical experts in good agricultural practices or food safety
- United Nations, Food and Agricultural Organisation, World Health Organisation, World Trade Organisation or International Standards Organisations
- Researchers and lecturers at Colleges, Technical universities or Universities

What career opportunities exist for graduates?



Consultant plant pathologists often collaborate with economists, soil scientists, horticulturists, entomologists and farmers, big corporates, pesticide companies or retailers. They not only advise, but also influence governments, industry and the general public regarding critical matters such as trade, phytosanitary and sanitary matters, and the right to food.



Lecturers and researchers at universities and technical colleges provide quality creative education and share their skills and experiences with students to prepare them for careers in the flower industry, turf grass or horticultural sectors, crop production, viticulture, agronomy, soil sciences and entomology, as well as agricultural economics. They are classical transdisciplinary thinkers who can solve mega problems and are innovative in finding practical solutions for farmers and others in the agricultural sector.



Agricultural scientists and researchers at various companies and academic institutions research many different aspects of plant health, crop protection, food security and food safety.

Minimum admission requirements

Programme	Minimum requirements for NSC and IEB for 2023			
	Achievement level			APS
	English Home Language or English First Additional Language	Mathematics	Physical Sciences	
BScAgric (Plant Pathology) [4 years] Close on availability of space: As soon as the number of places available for this programme are filled, it will be closed for further applications.	5	5	5	32

Agricultural and Food Sciences

Plant and Soil Sciences

BScAgric (Applied Plant and Soil Sciences)

BScAgric (Applied Plant and Soil Sciences) is a four-year, full-time degree programme. It teaches the principles of plant-based agriculture within the disciplines of agronomy, horticultural science, pasture science and soil science. Graduates can embark on a diverse range of careers in the agricultural and environmental fields.

Who is the ideal candidate?

Students who have a keen interest in plants and soil, would like to improve their understanding of the environment and want to make a difference in the world are the ideal candidates for this degree.

Graduates make a direct contribution to sustainable food production, while simultaneously protecting our natural resources.

What makes this programme unique?

This programme is unique in terms of the combination of disciplines taught within the degree. Students are exposed to the various fields within plant production and soil sciences, which ensures that graduates are well-rounded and able to access a wide array of career opportunities, or make informed decisions on specialisation should they wish to continue with postgraduate studies.

Our graduates are highly sought after and often have to choose between several offers of employment.

The degree is accredited by the South African Council for Natural Scientific Professions (SACNASP) and graduates can be registered as professional natural scientists.

What career opportunities exist for graduates?



Public sector

The Agricultural Research Council (ARC); government departments that address issues related to agriculture and rural development, water supply, conservation and the environment; the Council for Scientific and Industrial Research (CSIR); provincial departments of agriculture and nature conservation; the South African National Biodiversity Institute (SANBI); municipalities; South African National Parks; and national farming and food production agencies.



Entrepreneurial

Consultants to producers of crops, pastures, vegetables, medicinal and aromatic plants, and ornamental and cut-flowers; landscaping enterprises; managing own farms and nurseries for extensive (field) or intensive (tunnel/greenhouse) production systems involving various crops; and managing companies specialising in irrigation, reclamation and soil conservation.



Private sector

Companies involved in seed, fertilizer and plant protection research, development and marketing; environmental planning and management; nurseries; vegetable, fruit, ornamental and cut flower production; and irrigation.



Extension services involving knowledge transfer

Nature conservation; national and provincial departments of agriculture and the environment; environmental management and rehabilitation, including mine lands; nurseries; crop, turf grass and weed management; private companies servicing field crops, vegetables, medicinal and aromatic plants, fruit, ornamental and cut-flower production.

Agricultural and Food Sciences

Plant and Soil Sciences



'What I enjoyed most about this degree is that it exposed students to the diverse range of disciplines that form the basis of crop production, and that each discipline is unique yet connected to the others. Crop production is the perfect field for anyone who enjoys working on solving complex problems to have a meaningful impact on people's quality of life. My dream job is to continue with the work I am doing for my postgraduate studies, which is to find ways of making agricultural science accessible to smallholder farmers and the public in order to build a more equitable food system.'

– Richard Hay (MSc Student)



Minimum admission requirements

Programme	Minimum requirements for NSC and IEB for 2023			
	Achievement level			APS
	English Home Language or English First Additional Language	Mathematics	Physical Sciences	
BScAgric (Applied Plant and Soil Sciences) [4 years] Close on availability of space: As soon as the number of places available for this programme are filled, it will be closed for further applications.	5	5	5	32

Physical Sciences

Chemistry

BSc (Chemistry)

Chemistry is the study, understanding and analysis of substances and materials and how they interact. This is achieved through carefully designed laboratory experiments using sophisticated instrumentation, mathematical calculations, data processing and modelling.

Who is the ideal candidate?

The ideal candidate will have the following characteristics:

- Ability to work with high precision and accountability
- Good time management
- Proficiency in scientific writing
- Ability to work in a team
- Good management skills
- Environmental consciousness in work ethic

What makes this programme unique?

BSc (Chemistry) graduates have the ability to combine concepts across different fields. They develop excellent analytical and problem-solving skills, which can also be applied in less traditional fields, for example the financial sector and information technology. Chemistry is the central science and links with many other subjects, including physics, mathematics, biochemistry, computer science, geology, etc.

Which companies employ our graduates?

Our graduates are employed by:

- chemical manufacturers;
- mining companies;
- government departments;
- the media;
- law firms;
- laboratories;
- cosmetic companies;
- instrument manufacturers;
- pharmaceutical companies; and
- education companies.

What career opportunities exist for graduates?

Graduates are equipped for careers in the following fields:



'Chemistry used to be that one class I dreaded taking back in high school, but that completely changed for me when I started taking chemistry in my first year as a BSc student. Chemistry went from this impossible amount of memorization to this fascinating field of logic that I got to witness in my everyday life. I started realizing how applicable the principles of chemistry are in my life and found myself wanting to learn more for that reason. When it came to choosing a career, I decided to focus on biochemistry and delve into how chemistry plays a role in biotic factors and am now pursuing a career in food safety.'

– Chrizelda Visser



'If someone had told me while I was in high school that I would one day enroll for a degree in chemistry, I would have called them crazy. Not that I did not like the subject but I did not find it interesting. When I registered for the module in first year, it was just a core module that I had to do but when I started learning more, I fell in love with it. For the first time, everything that I had been introduced to in high school made perfect sense. It was even more amazing that I could explain why and how certain reactions take place. My dream has always been to work in the field of forensic science. The added fact that it is such a broad field makes forensic chemistry my destination.'

– Daisy Mdeka

Minimum admission requirements

Programme	Minimum requirements for NSC and IEB for 2023			
	Achievement level			APS
	English Home Language or English First Additional Language	Mathematics	Physical Sciences	
BSc (Chemistry) [3 years] Close on availability of space: As soon as the number of places available for this programme are filled, it will be closed for further applications.	5	5	5	34

Physical Sciences

Geology

BSc (Geology)

Geology is the study of the Earth and includes aspects related to its formation, composition, structure and processes. South Africa is known for its large reserves of gold, platinum, chromium, vanadium and other metal ores, as well as substantial diamond and coal reserves. A mere hour's drive from UP takes one to the Karoo coalfields, the site where the Cullinan diamond was discovered, the Bushveld platinum mines and the gold mines of the Witwatersrand. South Africa also has some of the Earth's oldest well-exposed geology and significant fossils informing us about the history of the planet.

Who is the ideal candidate?

The programme requires an appreciation for mathematics and chemistry. A love for the Earth and working outdoors, and an interest in geology or geomorphology will be beneficial. Depending on your personality, you can decide how you would like to divide your time between working in the field and working in the office.

What makes this programme unique?

UP is well situated within easy reach of the mining and applied geological industries and offers a strong programme in the applied fields of economic geology, structural geology and mechanics, and engineering geology and hydrogeology. Candidates who successfully complete this programme qualify for professional registration as geological scientists.

What career opportunities exist for graduates?

Geology is split into many subdisciplines which include mineralogy (the study of rock-forming minerals), petrology (the study of rock formation), structural geology (the deformation and behaviour of rock under stress) and economic or mining geology (identification of mineral resources and contribution to the day-to-day operations of mines).

As a geologist, you can choose whether you would prefer to work in a mine or laboratory, or as an exploration geologist in the field. The programme also allows entry into applied geological professions such as hydrogeology and engineering geology.

Apart from working in the mining industry, candidates also find employment at analytical facilities, in forensics, or in the insurance industry.

Which companies employ our graduates?

Our graduates are employed as economic or exploration geologists in the mining industry, or work for parastatals (Council for Geoscience, CSIR, Mintek) or government (Mineral Resources; Energy).

Minimum admission requirements

Programme	Minimum requirements for NSC and IEB for 2023			
	Achievement level			APS
	English Home Language or English First Additional Language	Mathematics	Physical Sciences	
BSc (Geology) [3 years] Close on availability of space: As soon as the number of places available for this programme are filled, it will be closed for further applications.	5	5	5	34



GEOLOGY



Physical Sciences

Geology

BSc (Engineering and Environmental Geology)

The degree offers further specialisation in engineering geology and hydrogeology. Engineering geology is the study of the behaviour of ground (soil and rock) and how likely it is to affect engineering works. It comprises geotechnical studies and relates to construction (eg founding or excavation) on and with geological materials (eg construction materials), and to the influences of geological, geomorphological and hydrological processes on construction and development. Hydrogeology refers to the occurrence, distribution and movement of water below the Earth's surface. The study of groundwater is generally both quantitative (eg water supply, safe abstraction and the influences of pumping) and qualitative (eg contamination, remediation and drinking water).

Who is the ideal candidate?

The programme requires a strong understanding of mathematics and mechanics. Genuine concern for Planet Earth, a desire to work outdoors and an interest in geology or geomorphology will be an advantage. Depending on your personality, you can choose how you would like to divide your time between doing fieldwork and working on a computer.

What makes this programme unique?

Very few universities offer professional qualifications in engineering geology and hydrogeology. UP offers both, which places it in a strong position on the interface between infrastructure development and subsurface water. The qualification complies with the requirements for professional registration.

ENGINEERING GEOLOGY



GEOLOGY



HYDROGEOLOGY

What career opportunities exist for graduates?

Engineering geologists work closely with civil engineers, mining engineers, town planners and environmental scientists. Your work will require you to identify geological hazards, source building materials and supply foundation solutions.

As a hydrogeologist you will be involved in the supply of water for urban, agricultural and industrial use. Nowadays many graduates work in contaminant transport and remediation, which involves identifying sources of pollution and finding suitable remediation solutions.

Which companies employ our graduates?

Our graduates are employed by civil and infrastructure industries, the mining industry and parastatals (Council for Geoscience; CSIR), as well as by government (Department of Water Affairs; the NHBRC; local governments).

Minimum admission requirements

Programme	Minimum requirements for NSC and IEB for 2023			
	Achievement level			APS
	English Home Language or English First Additional Language	Mathematics	Physical Sciences	
BSc (Engineering and Environmental Geology) [3 years] Close on availability of space: As soon as the number of places available for this programme are filled, it will be closed for further applications.	5	5	5	34

Physical Sciences

Geography, Geoinformatics and Meteorology

BSc (Geography and Environmental Science)

Geographers and environmental scientists study processes, relationships and the interdependence between the natural environment and humans. Anyone who has a passion for the environment and has a background in the sciences will be interested in the BSc (Geography and Environmental Science) programme.



What makes this programme unique?

The programme enhances students' understanding of the physical, social and constructed environments, incorporating all the natural processes that take place on earth, as well as the socio-political and cultural activities that dominate the planet.

Which companies employ our graduates?

- In the private sector, graduates are generally employed by real estate, planning, architectural and engineering firms, and by banks, tourism organisations, environmental conservation bodies and industry.
- Government departments such as the Departments of Environment, Forestry and Fisheries (DEFF), Agriculture, Land Reform and Rural Development (DALRRD), Water and Sanitation (DWS), Tourism (DT), Basic Education (DBE) and Higher Education and Training (DHET), and Statistics South Africa (Stats SA)
- Parastatal organisations such as the South African Bureau of Standards (SABS), the South African Biodiversity Institute (SANBI) and the Council for Scientific and Industrial Research (CSIR).
- Self-employed, working mainly in areas such as marketing, planning, development, tourism, cartography, remote sensing, environmental analysis, social impact assessments and environmental auditing.

Geography and environmental sciences offer a range of career paths, including teaching, research (for a variety of bodies) and careers requiring the application of geographical knowledge and skills in practice. Graduates can focus on environmental management; urban development issues, regional and rural development; and environmental health or environmental issues, including pollution, climate change and the understanding and addressing of negative impacts on biodiversity/ecosystem services through activities such as mining, agriculture and tourism.



Minimum admission requirements

Programme	Minimum requirements for NSC and IEB for 2023			
	Achievement level			APS
	English Home Language or English First Additional Language	Mathematics	Physical Sciences	
BSc (Geography and Environmental Sciences) [3 years] Close on availability of space: As soon as the number of places available for this programme are filled, it will be closed for further applications.	5	5	5	34

Physical Sciences

Geography, Geoinformatics and Meteorology

BSc (Geoinformatics)



The BSc (Geoinformatics) programme entails the collection, storage, analysis, visualisation and management of geospatial information by using an assortment of geospatial analytical methods and tools to help with decision making and providing solutions to geographic problems. Our graduates have a passion for geography, an interest in collecting, processing, displaying and analysing geographic information, and deriving, geospatial data products, and an interest in using computing technology and quantitative techniques to address geographical problems.

What makes this programme unique?

The programme is accredited by the South African Geomatics Council for registration as candidate Geomatics Technologists in GISc (GTg, GISc).

What career opportunities exist for graduates?

Web programmer, geospatial data officer, geospatial software developer, mobile app developer, geovisualisation specialist, GIS project manager, GISc consulting, map designer, spatial data analyst, earth observation data analyst and systems analyst.

Which companies employ our graduates?

Graduates with a BSc (Geoinformatics) readily find work at organisations such as:

- The Environmental Systems Research Institute (ESRI) South Africa;
- Intergraph Systems Southern Africa;
- The Council for Scientific and Industrial Research (CSIR);
- The Agricultural Research Council (ARC);
- AfriGIS; GeoTerralimage; GISCOE; Aurecon;
- The South African National Space Agency (SANSA);
- South Africa's national mapping organisation (National Geospatial Information (NGI);
- Any municipality in the country;
- Many government departments (eg Environmental Affairs, Forestry and Fisheries (DEFF); Science and Innovation (DSI); Statistics South Africa; and Agriculture, Land Reform and Rural Development (DALRRD); and Water and Sanitation (DWS).



'I enjoy the BSc (Geoinformatics) degree programme because we are exposed to many different fields in a short time: geography, business, IT, law, mathematics, remote sensing, cartography, geodesy and statistics. This degree programme is challenging, yet extremely interesting. I am never bored! I enjoy statistics and analysis, this combination can be used in GIS. Any job that combines these activities would definitely be my dream job! Most of all I dream of working in Google's spatial department!'

– Kayla Theron



'Geoinformatics is a fascinating degree as it allows you to work in a variety of fields from agriculture to transport planning which I enjoy as I have many interests. I enjoyed the visual and programming aspects of the degree as they are very rewarding as you can see a final product at the end. In the future, I aim to be a GIS specialist that can work on projects that can help impact people's lives for the better by creating spatial solutions.'

– Terisha Pillay



'I have a passion for solving real-world issues and enjoy working with state-of-the-art technologies. The BSc (Geoinformatics) programme also teaches problem solving, critical thinking, project management and other highly sought-after skills. My dream job is to work for a GIS consultancy. This will allow me to work in many different industries while I continue learning.'

– Nicholas de Kock

Minimum admission requirements

Programme	Minimum requirements for NSC and IEB for 2023			
	Achievement level			APS
	English Home Language or English First Additional Language	Mathematics	Physical Sciences	
BSc (Geoinformatics) [3 years] Close on availability of space: As soon as the number of places available for this programme are filled, it will be closed for further applications.	5	5	5	34

Physical Sciences

Geography, Geoinformatics and Meteorology

BSc (Meteorology)

The BSc (Meteorology) programme focuses on the study of atmospheric processes. An ideal candidate is someone who is fascinated by weather phenomena and is interested in all things concerned with natural science.



What makes this programme unique?

This is the only Meteorology programme offered in South Africa and the SADC region.

A student who has successfully completed the BScHons (Meteorology) degree will be regarded as a Class 1 Meteorologist by the World Meteorological Organisation.

The BScHons (Meteorology) degree, which is required to become a professional meteorologist, complies fully with the Manual on the Implementation of Education and Training Standards in Meteorology and Hydrology Volume I – Meteorology.

Which companies employ our graduates?

Meteorologists are employed by institutions involved in the study, interpretation and prediction of weather and climate-related phenomena.

Our graduates are employed at:

- The South African Weather Service (SAWS)
- International Weather Services and companies (for instance in New Zealand, Dubai and Australia)
- The Council for Scientific and Industrial Research (CSIR)
- Universities in South Africa and abroad

Researchers

They research all aspects of the weather and climate to improve man's understanding of atmospheric phenomena. Atmospheric modellers use supercomputers to solve complex flow dynamic equations of the atmosphere. The monitoring of air quality and the modelling of the impact of air pollution on society are two important aspects that need to be addressed. Research on climate change is receiving increasing attention.

Weather forecasters

The weather forecaster must analyse data and predict the weather by using models that are run on supercomputers. Weather forecasts are issued on different time scales, from very short-range forecasting to forecasts that are valid for months ahead, as well as seasonal forecasts.

Private positions for people with this qualification include presenting the weather forecast on television.

What career opportunities exist for graduates?

Climatologists

They manage essential data sets that contain large volumes of information gathered by the SAWS and other organisations.

Consultants

Some meteorologists who work as consultants in the private sector and at universities provide specialised research services.

Lecturers

A few academic positions for meteorologists and climatologists are available at South African universities.

Minimum admission requirements

Programme	Minimum requirements for NSC and IEB for 2023			
	Achievement level			APS
	English Home Language or English First Additional Language	Mathematics	Physical Sciences	
BSc (Meteorology) [3 years] Close on availability of space: As soon as the number of places available for this programme are filled, it will be closed for further applications.	5	5	5	34

Physical Sciences

Physics

BSc (Physics)

The useful and transferable skills that physics students acquire in theoretical, experimental and computational physics equip them for a variety of career options. The BSc (Physics) programme will appeal to students who are passionate about understanding nature, are driven by curiosity, are interested in mathematics and are willing to put in the required effort.

What makes this programme unique?

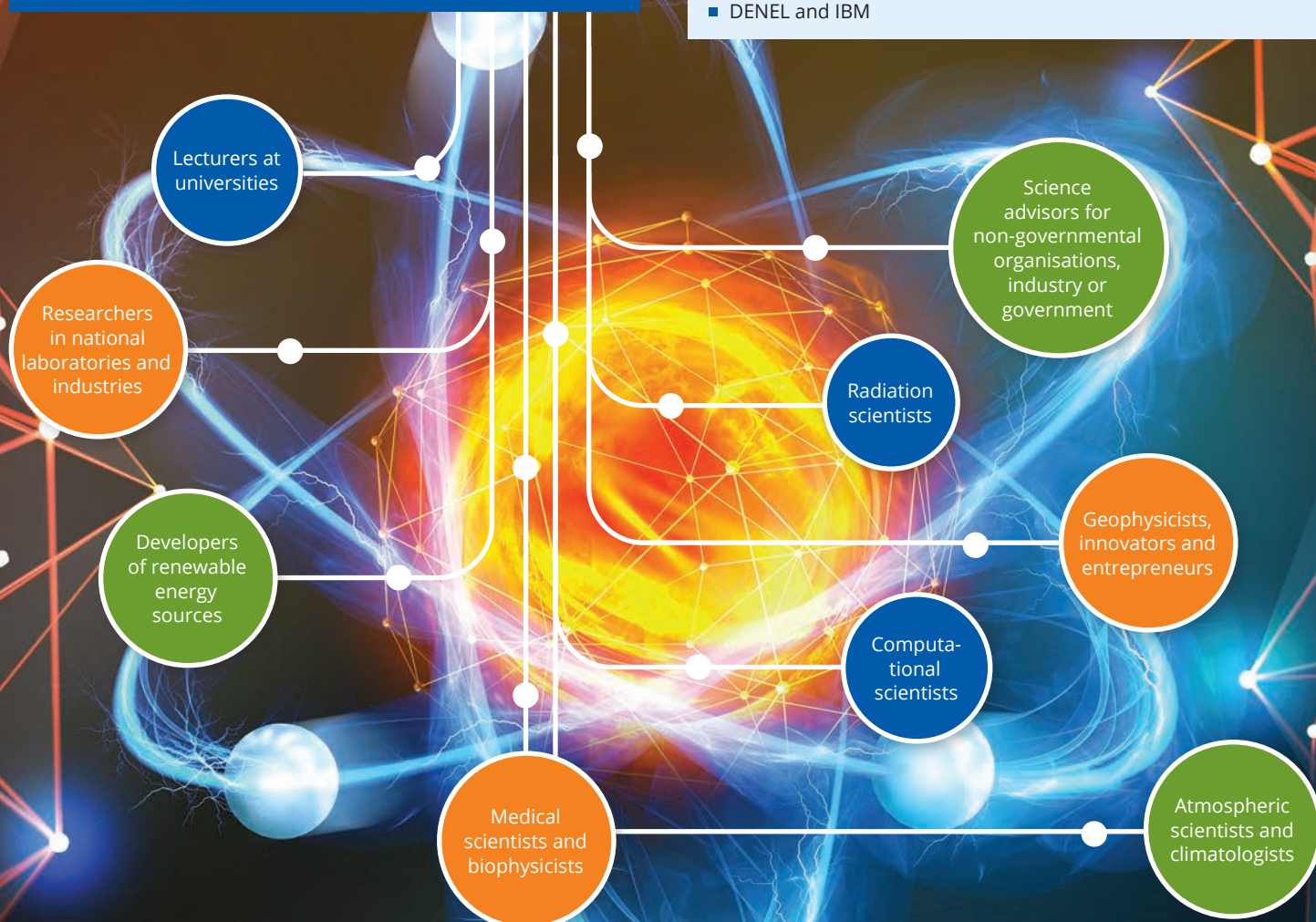
Physics students will develop their creativity, inventiveness, problem-solving abilities, analytical thinking skills and their ability to communicate complex ideas.

What career opportunities exist for graduates?

Which companies employ our graduates?

Our graduates are employed by:

- Nuclear Energy Corporation of South-Africa (NECSA)
- South African Astronomical Observatory (SAAO)
- Square Kilometre Array (SKA)
- South African National Space Agency (SANSA)
- iThemba LABS (Laboratory for Accelerator-based Sciences)
- The Council for Scientific and Industrial Research (CSIR)
- DENEL and IBM



Minimum admission requirements

Programme	Minimum requirements for NSC and IEB for 2023			
	Achievement level			APS
	English Home Language or English First Additional Language	Mathematics	Physical Sciences	
BSc (Physics) [3 years] Close on availability of space: As soon as the number of places available for this programme are filled, it will be closed for further applications.	5	5	5	34

Mathematical Sciences

Actuarial Science

BSc (Actuarial and Financial Mathematics)

The modern financial world has a growing need for graduates who are well skilled in analytical problem solving, modelling and other quantitative techniques. The programme provides students with a broad education and skills development in these areas. Students can tailor their coursework to either an actuarial or a financial mathematics option.

The actuarial programme is structured to provide the aspiring actuary with the opportunity to fulfil the requirements needed for exemption from the Actuarial Society of South Africa examinations in the shortest possible time. For aspiring financial analysts or financial engineers, the programme provides depth and develops the student's ability to design and analyse financial products.



Who is the ideal candidate?

The ideal candidates are students who achieve seven or more A's easily in high school. They are involved in a variety of sports and cultural activities and usually hold leadership positions throughout high school. They are well-balanced and very motivated.

While not prerequisites at school, prospective students are probably taking and enjoying an AP Mathematics course, where possible. They are also likely to enjoy coding or solving problems using a computer where these opportunities are available.



What makes this programme unique?

The study programme prepares students for qualification as actuaries or financial engineers. Specialisation in either of these fields occurs in the third year of study and continues at postgraduate level.

The programme is accredited with the Actuarial Society of South Africa and gives students the opportunity to earn exemptions from the A100 and A200 subjects of the Actuarial Society during their undergraduate degree. To achieve further exemptions, a follow-up honours degree is recommended.

We prepare our students to compete in the actuarial workplace. Large employers of actuarial students speak highly of our graduates and some actively seek students from our programme.

What is an actuary?

An actuary is a professional who applies analytical, statistical and mathematical skills to financial and business problems. This is especially valuable when facing real-world problems that involve uncertain future events or financial risk. This ability to quantify that which is unclear helps individuals and businesses to safeguard their future, confidently and at a fair price, in an ever-changing world. (Actuarial Society of South Africa).



What career opportunities exist for graduates?

Many actuaries follow careers in the more traditional fields of insurance and retirement funds. However, actuaries are also increasingly working in other fields following recognition of their analytical skills. This includes healthcare, financial consulting, risk management and banking. Because of their unique skills, many actuaries are appointed to senior management positions after their initial analytical roles.

Financial engineers can be employed by banks and financial institutions, brokerage firms and investment institutions. They are essential in portfolio and risk management. Activities include asset management (trading in bonds, futures and derivative instruments such as options), designing new financial products and devising strategies to control credit risk.



Which companies employ our graduates?

BSc (Actuarial and Financial Mathematics) graduates are generally employed by:

- accounting firms
- banks
- consulting firms
- insurance companies
- investment companies
- medical schemes
- universities

Minimum admission requirements

Programme	Minimum requirements for NSC and IEB for 2023		
	Achievement level		APS
	English Home Language or English First Additional Language	Mathematics	
BSc (Actuarial and Financial Mathematics) [3 years] Close on availability of space: As soon as the number of places available for this programme are filled, it will be closed for further applications.	5	7	36

Mathematical Sciences

Mathematics and Applied Mathematics

BSc (Mathematics) and BSc (Applied Mathematics)

Mathematics, which originated from arithmetic and geometry, is based on patterns and structures and is the fundamental language of science and technology. Applied mathematics is concerned with the modelling and treatment of real-life problems in a variety of fields, such as engineering, finance, statistics, physics and biology. The power of mathematics and applied mathematics lies in their abstract, analytical and computational nature. Nowadays, mathematics is essential for all technological, financial and managerial industries, which form the backbone of the South African economy.

BSc (Mathematics)

Compulsory subjects are:

- Analysis
- Abstract algebra
- Geometry (third-year level)
- Calculus
- Linear algebra
- Differential equations
- Discrete structures (second-year level)
- Mathematical modelling
- Mathematical statistics
- Numerical analysis
- Dynamical processes (first-year level)

BSc (Applied Mathematics)

Compulsory subjects are:

- Analysis
- Continuum mechanics
- Numerical analysis
- Partial differential equations
- Dynamical systems (third-year level)
- Calculus
- Linear algebra
- Discrete structures
- Differential equations (second-year level)
- Mathematical modelling
- Mathematical statistics
- Dynamical processes (first-year level)



Who is the ideal candidate?

Mathematics students who enjoy the course and excel in it are those who enjoy solving problems and have a strong background in the basics of the subject.



What career opportunities exist for graduates?

Graduates in mathematics and applied mathematics are employed by research institutions, in education (universities and schools), the public sector (government and medical institutions) and the private sector (engineering companies, financial institutions and the computer industry).

The training of these graduates in abstract, analytical and computational thinking provides them with the versatile background required to easily adjust to changing circumstances in the professional environment and to construct mathematical models of natural, technological and financial phenomena. Mathematicians and applied mathematicians apply, evaluate and adapt existing problem-solving techniques or develop new techniques to solve those problems.



What makes this programme unique?

The Department of Mathematics and Applied Mathematics is not only one of the largest departments on the Hatfield Campus, but also one of the largest mathematics departments in the country, with approximately 17 500 student enrolments for mathematics modules. The Department prides itself on excelling in teaching and research, as well as in community-based activities.

The diverse and competent staff has expertise in various fields. The Department regularly hosts international visitors and its researchers frequently travel abroad to attend conferences and pay research visits. No fewer than 31 of its researchers have received NRF ratings in fields ranging from more traditional abstract analysis to contemporary epidemiology, where the modelling of biological phenomena leads to exciting options.

A degree in mathematics trains students to apply, evaluate and adapt existing problem-solving techniques, or to develop new mathematical models and techniques to solve problems stemming from natural, technological and financial phenomena.



Which companies employ our graduates?

A BSc (Mathematics) or BSc (Applied Mathematics) degree is a solid foundation for a professional career in many fields. Many of our graduates are employed by the banking and financial sector, but also in new fields like bioinformatics, genetics, management consulting, weather forecasting, etc. As there is a general shortage of mathematicians in South Africa, top performing students opt for further studies and an academic career.

Minimum admission requirements

Programmes	Minimum requirements for NSC and IEB for 2023		
	Achievement level		APS
	English Home Language or English First Additional Language	Mathematics	
BSc (Mathematics) BSc (Applied Mathematics) [3 years] Close on availability of space: As soon as the number of places available for this programme are filled, it will be closed for further applications.	5	6	34

Mathematical Sciences

Statistics

BSc (Mathematical Statistics)

Statistics is the science of extracting information from a variety of data sources utilising cutting-edge technologies that enable companies and institutions to remain abreast and to be globally competitive. Statistics and data science form the foundation on which so much future development takes place. Superb opportunities exist for students who are keen to distinguish themselves in this field. You will not only enjoy an extraordinary and rewarding career, you will also receive an above-average remuneration package.



Who is the ideal candidate?

An ideal candidate for this programme is someone with:

- strong numerical skills;
- interest in computers and computer programming;
- logical reasoning ability and critical thinking skills; and
- strong problem-solving skills.



What makes this programme unique?

The Statistics programme can uniquely combine students' interest in mathematical statistics with their interest in, for example, insurance science, economics, mathematics and applied mathematics.

By completing this programme you will therefore be positioned at the forefront of analytical thinking and application in the statistical, computational and interdisciplinary environments of the future.



Which companies employ our graduates?

- Commerce companies (especially online shopping, customer analytics and recommender systems)
- Financial and banking companies
- Health companies
- Information technology companies
- Insurance and accounting companies
- Logistics and transport companies
- Pharmaceutical industries
- Research and development organisations
- Telecommunication companies
- Universities and other education bodies



Minimum admission requirements

Programme	Minimum requirements for NSC and IEB for 2023		
	Achievement level		APS
	English Home Language or English First Additional Language	Mathematics	
BSc (Mathematical Statistics) [3 years] Close on availability of space: As soon as the number of places available for this programme are filled, it will be closed for further applications.	5	6	34

Student life/Community engagement initiatives

Student life

NATHouse

NATHouse is the official student house of the Faculty of Natural and Agricultural Sciences. By default, all students registered with the Faculty of Natural and Agricultural Sciences are members of NATHouse. Our logo, which shows a stem sprouting leaves, represents our belief that the desire to learn is a guide to life. It expresses our drive to continuously overcome daily difficulties by looking for new methods to solve them. Science is, after all, focused on research and innovation.

We aim to help students to reach their academic goals and achieve optimal academic performance. The House also assists with non-academic issues and provides some 'off-the desk' activities to help students take a break from their studies.

Our Vision

We believe that the love of learning is a guide to life and aim to

- motivate our student members to achieve academic excellence in the sciences;
- connect our members with the working sector, inspiring them to cultivate their talents and contribute to society;
- emphasise the value of sciences – on campus and in our communities;
- participate in University activities on various levels; and
- provide students with the necessary personal and professional development through personal and professional well-being sessions, various community engagement projects and sports.

Contact information

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Agricultural Annex 2–6
Hatfield Campus
Tel +27 (0)12 420 6540
Email nathousetuks@gmail.com
Website www.up.ac.za/nathouse

A problem shared is a problem halved! Visit us at our offices to discuss any issues, academic or non-academic that might be troubling you. We are here to assist you, and while we are at it, we may even offer you some coffee!

Community engagement initiatives

Sci-Enza

Sci-Enza, a science centre at the University of Pretoria, is the oldest science centre on the African continent and has been involved in raising science awareness and communicating science to the South African public for more than 40 years. Our mission is to make science accessible to learners of all ages in a fun and entertaining way and, in doing so, to raise science awareness.

Our vision is to promote greater understanding and awareness of science and technology among South Africans and to foster public engagement with science. We are committed to creating a learning environment where SCIENCE AND IMAGINATION UNITE! This is achieved through interactive exhibits, exciting programmes and memorable experiences with science both on the premises and through outreach. Sci-Enza is open during office hours on weekdays.

Please contact +27 (0)12 420 3767 or email sci-enza@up.ac.za for more information and to make an appointment.



1	2
Ia	Ila

Periodic Table of the Elements

- Pink (left):** the s block elements (consisting: hydrogen, alkali metals, alkaline earth metals).
- Blue (middle):** the d block elements (they are the transition metals).
- Yellow (right):** the p block elements (consisting: some metals, metalloids, non-metals, noble gases, and halogens).
- Peach (two rows at the bottom):** the f block elements (they are the inner transition elements, consisting of actinides and lanthanides).
- Symbols printed in **solid black**: solids at 25°C.
- Symbols printed in **white with outline**: gases at 25°C.
- Symbols printed in **grey with outline**: liquids at 25°C.



Dmitri Mendeleev

1	2
H Hydrogen 1.0079 2.2 1s ¹	

3	4
Li Lithium [He] 2s ¹ 6.941 1.0 1.5	Be Beryllium [He] 2s ² 9.0122 1.0 1.5

11	12
Na Sodium [Ne] 3s ¹ 22.990 1.0 1.2	Mg Magnesium [Ne] 3s ² 24.305 1.0 1.2

19	20
K Potassium [Ar] 4s ¹ 39.098 0.9 1.0	Ca Calcium [Ar] 4s ² 40.078 1.0 1.0

37	38
Rb Rubidium [Kr] 5s ¹ 85.468 0.9 1.0	Sr Strontium [Kr] 5s ² 87.62 1.0 1.0

55	56
Cs Caesium [Xe] 6s ¹ 132.91 0.9 1.0	Ba Barium [Xe] 6s ² 137.33 1.0 1.0

87	88
Fr Francium [Rn] 7s ¹ 223.02 0.9 1.0	Ra Radium [Rn] 7s ² 226.03 1.0 1.0

Atomic number	88
Symbol	Ra
Element name	Radium
Atomic mass	226.03
Electronegativity	1.0
Electron configuration	[Rn] 7s ²

3	4	5	6	7	8	9	10	11	12
IIIB	IVB	VB	VIB	VIIb	VIIIb	VIIIb	VIIIb	Ib	IIb

21	22	23	24	25	26	27	28	29	30
Sc Scandium [Ar] 3d ¹ 4s ² 44.956 1.2 1.1	Ti Titanium [Ar] 3d ² 4s ² 47.88 1.3 1.3	V Vanadium [Ar] 3d ³ 4s ² 50.942 1.5 1.5	Cr Chromium [Ar] 3d ⁵ 4s ¹ 51.996 1.6 1.6	Mn Manganese [Ar] 3d ⁵ 4s ² 54.938 1.6 1.6	Fe Iron [Ar] 3d ⁶ 4s ² 55.845 1.6 1.6	Co Cobalt [Ar] 3d ⁷ 4s ² 58.933 1.7 1.7	Ni Nickel [Ar] 3d ⁸ 4s ² 58.693 1.8 1.8	Cu Copper [Ar] 3d ¹⁰ 4s ¹ 63.546 1.8 1.8	Zn Zinc [Ar] 3d ¹⁰ 4s ² 65.41 1.7 1.7

39	40	41	42	43	44	45	46	47	48
Y Yttrium [Kr] 4d ¹ 5s ² 88.906 1.1 1.1	Zr Zirconium [Kr] 4d ² 5s ² 91.2245 1.2 1.2	Nb Niobium [Kr] 4d ⁴ 5s ¹ 92.906 1.3 1.3	Mo Molybdenum [Kr] 4d ⁵ 5s ¹ 95.94 1.3 1.3	Tc Technetium [Kr] 4d ⁵ 5s ¹ 98.906 1.4 1.4	Ru Ruthenium [Kr] 4d ⁷ 5s ¹ 101.07 1.4 1.4	Rh Rhodium [Kr] 4d ⁸ 5s ¹ 102.91 1.5 1.5	Pd Palladium [Kr] 4d ¹⁰ 106.42 1.4 1.4	Ag Silver [Kr] 4d ¹⁰ 5s ¹ 107.87 1.4 1.4	Cd Cadmium [Kr] 4d ¹⁰ 5s ² 112.41 1.5 1.5

57	58	59	60	61	62	63	64	65	66
La Lanthanum [Xe] 5d ¹ 6s ² 138.91 1.1 1.1	Ce Cerium [Xe] 4f ¹ 6s ² 140.12 1.1 1.1	Pr Praseodymium [Xe] 4f ³ 6s ² 140.91 1.1 1.1	Nd Neodymium [Xe] 4f ⁴ 6s ² 144.24 1.1 1.1	Pm Promethium [Xe] 4f ⁵ 6s ² 146.92 1.1 1.1	Sm Samarium [Xe] 4f ⁶ 6s ² 150.36 1.1 1.1	Eu Europium [Xe] 4f ⁷ 6s ² 151.96 1.0 1.0	Gd Gadolinium [Xe] 4f ⁷ 6s ² 157.25 1.1 1.1	Tb Terbium [Xe] 4f ⁹ 6s ² 158.93 1.1 1.1	Dy Dysprosium [Xe] 4f ¹⁰ 6s ² 162.50 1.1 1.1

71	72	73	74	75	76	77	78	79	80
Lu Lutetium [Xe] 4f ¹⁴ 5d ¹ 6s ² 174.97 1.1 1.1	Hf Hafnium [Xe] 4f ¹⁴ 5d ² 6s ² 178.49 1.2 1.2	Ta Tantalum [Xe] 4f ¹⁴ 5d ³ 6s ² 180.95 1.3 1.3	W Tungsten [Xe] 4f ¹⁴ 5d ⁴ 6s ² 183.84 1.4 1.4	Re Rhenium [Xe] 4f ¹⁴ 5d ⁵ 6s ² 186.21 1.5 1.5	Os Osmium [Xe] 4f ¹⁴ 5d ⁶ 6s ² 190.23 1.5 1.5	Ir Iridium [Xe] 4f ¹⁴ 5d ⁷ 6s ² 192.22 1.6 1.6	Pt Platinum [Xe] 4f ¹⁴ 5d ⁹ 6s ¹ 195.08 1.4 1.4	Au Gold [Xe] 4f ¹⁴ 5d ¹⁰ 6s ¹ 196.97 1.4 1.4	Hg Mercury [Xe] 4f ¹⁴ 5d ¹⁰ 6s ² 200.59 1.5 1.5

89	90	91	92	93	94	95	96	97	98
Ac Actinium [Rn] 6d ¹ 7s ² 227.03 1.0 1.0	Th Thorium [Rn] 6d ² 7s ² 232.04 1.1 1.1	Pa Protactinium [Rn] 5f ² 6d ¹ 7s ² 231.04 1.1 1.1	U Uranium [Rn] 5f ³ 6d ¹ 7s ² 238.03 1.2 1.2	Np Neptunium [Rn] 5f ⁴ 6d ¹ 7s ² 237.05 1.2 1.2	Pu Plutonium [Rn] 5f ⁶ 7s ² 244.08 1.2 1.2	Am Americium [Rn] 5f ⁷ 7s ² 244.06 1.2 1.2	Cm Curium [Rn] 5f ⁸ 7s ² 247.07 1.2 1.2	Bk Berkelium [Rn] 5f ⁹ 7s ² 247.07 1.2 1.2	Cf Californium [Rn] 5f ¹⁰ 7s ² 251.08 1.2 1.2

101	102	103	104	105	106	107	108	109	110
Md Mendelevium [Rn] 5f ¹² 7s ² 258.10 1.2 1.2	No Nobelium [Rn] 5f ¹⁴ 7s ² 259 1.2 1.2	Lr Lawrencium [Rn] 5f ¹⁴ 7s ² 262.11 1.2 1.2	Rf Rutherfordium [Rn] 6d ² 7s ² 261.11 1.0 1.0	Db Dubnium [Rn] 6d ³ 7s ² 262.11 1.0 1.0	Sg Seaborgium [Rn] 6d ⁴ 7s ² 266 1.0 1.0	Bh Bohrium [Rn] 6d ⁵ 7s ² 264 1.0 1.0	Hs Hassium [Rn] 6d ⁶ 7s ² 277 1.0 1.0	Mt Meitnerium [Rn] 6d ⁷ 7s ² 268 1.0 1.0	Ds Darmstadtium [Rn] 6d ⁸ 7s ² 271 1.0 1.0

111	112	113	114	115	116	117	118	119	120
Rg Roentgenium [Xe] 4f ¹⁴ 5d ¹⁰ 6s ¹ 272 1.1 1.1	Cn Copernicium [Xe] 4f ¹⁴ 5d ¹⁰ 6s ² 285 1.1 1.1	Nh Nihonium [Xe] 4f ¹⁴ 5d ¹⁰ 6s ² 286 1.1 1.1	Fl Flerovium [Xe] 4f ¹⁴ 5d ¹⁰ 6s ² 289 1.1 1.1	Mc Moscovium [Xe] 4f ¹⁴ 5d ¹⁰ 6s ² 289 1.1 1.1	Lv Livermorium [Xe] 4f ¹⁴ 5d ¹⁰ 6s ² 293 1.1 1.1	Ts Tennessine [Xe] 4f ¹⁴ 5d ¹⁰ 6s ² 294 1.1 1.1	Og Oganesson [Xe] 4f ¹⁴ 5d ¹⁰ 6s ² 294 1.1 1.1		

13	14	15	16	17	18
IIIA	IVA	VA	VIA	VIIA	VIIIA

5	6	7	8	9	10
B Boron [He] 2s ² 2p ¹ 10.811 2.0 2.0	C Carbon [He] 2s ² 2p ² 12.011 2.5 2.5	N Nitrogen [He] 2s ² 2p ³ 14.007 3.1 3.1	O Oxygen [He] 2s ² 2p ⁴ 15.999 3.5 3.5	F Fluorine [He] 2s ² 2p ⁵ 18.998 4.1 4.1	Ne Neon [He] 2s ² 2p ⁶ 20.18 4.1 4.1

13	14	15	16	17	18
Al Aluminium [Ne] 3s ² 3p ¹ 26.982 1.5 1.5	Si Silicon [Ne] 3s ² 3p ² 28.086 1.7 1.7	P Phosphorus [Ne] 3s ² 3p ³ 30.974 2.1 2.1	S Sulphur [Ne] 3s ² 3p ⁴ 32.066 2.4 2.4	Cl Chlorine [Ne] 3s ² 3p ⁵ 35.453 2.8 2.8	Ar Argon [Ne] 3s ² 3p ⁶ 39.948 2.8 2.8

31	32	33	34	35	36
Ga Gallium [Ar] 3d ¹⁰ 4s ² 4p ¹ 69.723 1.8 1.8	Ge Germanium [Ar] 3d ¹⁰ 4s ² 4p ² 72.64 2.0 2.0	As Arsenic [Ar] 3d ¹⁰ 4s ² 4p ³ 74.922 2.2 2.2	Se Selenium [Ar] 3d ¹⁰ 4s ² 4p ⁴ 78.96 2.5 2.5	Br Bromine [Ar] 3d ¹⁰ 4s ² 4p ⁵ 79.904 2.7 2.7	Kr Krypton [Ar] 3d ¹⁰ 4s ² 4p ⁶ 83.8 2.7 2.7

49	50	51	52	53	54
In Indium [Kr] 4d ¹⁰ 5s ² 5p ¹ 114.82 1.5 1.5	Sn Tin [Kr] 4d ¹⁰ 5s ² 5p ² 118.71 1.7 1.7	Sb Antimony [Kr] 4d ¹⁰ 5s ² 5p ³ 121.76 1.8 1.8	Te Tellurium [Kr] 4d ¹⁰ 5s ² 5p ⁴ 127.6 2.0 2.0	I Iodine [Kr] 4d ¹⁰ 5s ² 5p ⁵ 126.904 2.2 2.2	Xe Xenon [Kr] 4d ¹⁰ 5s ² 5p ⁶ 131.29 2.2 2.2

81	82	83	84	85	86
Tl Thallium [Xe] 4f ¹⁴ 5d ¹⁰ 6s ² 6p ¹ 204.38 1.4 1.4	Pb Lead [Xe] 4f ¹⁴ 5d ¹⁰ 6s ² 6p ² 207.20 1.6 1.6	Bi Bismuth [Xe] 4f ¹⁴ 5d ¹⁰ 6s ² 6p ³ 208.98 1.7 1.7	Po Polonium [Xe] 4f ¹⁴ 5d ¹⁰ 6s ² 6p ⁴ 209 1.8 1.8	At Astatine [Xe] 4f ¹⁴ 5d ¹⁰ 6s ² 6p ⁵ 210 2.0 2.0	Rn Radon [Xe] 4f ¹⁴ 5d ¹⁰ 6s ² 6p ⁶ 222.02 2.0 2.0

113	114	115	116	117	118
Nh Nihonium [Xe] 4f ¹⁴ 5d ¹⁰ 6s ² 6p ¹ 286 1.2 1.2	Fl Flerovium [Xe] 4f ¹⁴ 5d ¹⁰ 6s ² 6p ² 289 1.2 1.2	Mc Moscovium [Xe] 4f ¹⁴ 5d ¹⁰ 6s ² 6p ³ 289 1.2 1.2	Lv Livermorium [Xe] 4f ¹⁴ 5d ¹⁰ 6s ² 6p ⁴ 293 1.2 1.2	Ts Tennessine [Xe] 4f ¹⁴ 5d ¹⁰ 6s ² 6p ⁵ 294 1.2 1.2	Og Oganesson [Xe] 4f ¹⁴ 5d ¹⁰ 6s ² 6p ⁶ 294 1.2 1.2

69	70	71	72	73	74
Tm Thulium [Xe] 4f ¹³ 6s ² 168.93 1.1 1.1	Yb Ytterbium [Xe] 4f ¹⁴ 6s ² 173.04 1.1 1.1	Lu Lutetium [Xe] 4f ¹⁴ 6s ² 174.97 1.1 1.1			

101	102	103	104	105	106
Md Mendelevium [Rn] 5f ¹² 7s ² 258.10 1.2 1.2	No Nobelium [Rn] 5f ¹⁴ 7s ² 259 1.2 1.2	Lr Lawrencium [Rn] 5f ¹⁴ 7s ² 262.11 1.2 1.2			

107	108	109	110	111	112
Bohrium [Rn] 5f ¹⁴ 7s ² 264 1.0 1.0	Hassium [Rn] 5f ¹⁴ 7s ² 277 1.0 1.0	Meitnerium [Rn] 5f ¹⁴ 7s ² 268 1.0 1.0	Darmstadtium [Rn] 5f ¹⁴ 7s ² 271 1.0 1.0	Roentgenium [Xe] 4f ¹⁴ 5d ¹⁰ 6s ¹ 272 1.1 1.1	Copernicium [Xe] 4f ¹⁴ 5d ¹⁰ 6s ² 285 1.1 1.1

113	114	115	116	117	118
Nihonium [Xe] 4f ¹⁴ 5d ¹⁰ 6s ² 6p ¹ 286 1.2 1.2	Flerovium [Xe] 4f ¹⁴ 5d ¹⁰ 6s ² 6p ² 289 1.2 1.2	Moscovium [Xe] 4f ¹⁴ 5d ¹⁰ 6s ² 6p ³ 289 1.2 1.2	Livermorium [Xe] 4f ¹⁴ 5d ¹⁰ 6s ² 6p ⁴ 293 1.2 1.2	Tennessine [Xe] 4f ¹⁴ 5d ¹⁰ 6s ² 6p ⁵ 294 1.2 1.2	Oganesson [Xe] 4f ¹⁴ 5d ¹⁰ 6s ² 6p ⁶ 294 1.2 1.2



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