Faculty of Science
INFORMATION BROCHURE
Postgraduate Courses and Research Projects

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POSTGRADUATE COURSES AND RESEARCH PROJECTS IN THE FACULTY OF SCIENCE

GENERAL INFORMATION
The Faculty of Science at the University of Johannesburg (UJ) consists of a number of departments that represent diverse subject disciplines and working methods. Divergence does not result in an attenuation of strength. The entire Faculty is united in striving for excellence in four aspects, namely:

• the highest quality of undergraduate education;
• the highest quality of postgraduate education at all levels;
• the expansion of the different subject fields through a high level of sustained research;
• the involvement of the Faculty in addressing real and material problems in society and the environment.

Postgraduate students in the Faculty form a significant portion of the total number of students in the Faculty.

Numerous research projects are undertaken in the Faculty that cover a wide range of subject fields and address as many theoretical and practical problems as possible. Therefore, the Faculty is meeting its obligations not only with regard to science, but also with regard to society and the environment.

GENERAL ADMISSION REQUIREMENTS

Admission to postgraduate studies usually requires:

• A preceding degree in the relevant subject field or a degree in a related subject field that may be deemed equivalent to such a preceding degree;

OR

• Recognition of prior learning that is equivalent to the formal admission requirements for the respective degree study.

Information about how prior learning is recognised may be requested from the Dean’s office in the Faculty of Science.

Admission to postgraduate studies in the Faculty is subject to the approval of the department concerned. Apart from the generic admission requirement referred to above. Specific admission requirements may apply in the various departments. These requirements are explicated in the departmental subsections of this document.
**HONOURS**

Honours studies include the attendance of lectures in modules of the subject field together with either experimental projects of a limited scope or the independent study of designated subjects. Evaluation occurs through the writing of tests and examinations as well as the presentation and submission of seminars, project reports and assignments.

In some departments, Honours studies may be undertaken either full-time or part-time. The normal duration of full-time Honours study is one academic year and the duration of part-time study is two years.

Prospective students should refer to the respective departments for information about the specific modules and pass requirements.

**MASTER’S STUDIES**

As with Honours studies, Master’s studies may be undertaken full-time or part-time. Students also have the choice of undertaking research-based Master’s studies or coursework Master’s studies.

Research-based Master’s studies require the successful completion of a research project on an approved subject under the guidance of a supervisor, and the submission of a dissertation based on the research undertaken by the student.

Coursework Master’s studies require the attendance of lectures on selected aspects of the respective subject field and the submission of a minor-dissertation based on an independent investigation of a limited scope under the guidance of a supervisor.

All written examinations, minor-dissertations and dissertations are assessed by at least two external examiners from another university.

However, not all the departments offer both research-based and coursework Master’s degrees. Prospective students should refer to the respective departments for information about what is offered. The specific admission requirements are also provided under the respective departments.

In addition (same as for research masters), each prospective Master’s candidate have to submit to the supervisor at least one manuscript of a paper/article in the format required by an accredited journal for that specific discipline as a condition for graduation; the student will receive appropriate guidance from his/her supervisors in preparing the manuscript of the paper. Authorship of such a paper must be guided by UJ Guidelines on Authorship. Faculty regulations will stipulate under which conditions students may be exempted from needing to submit such a manuscript.

**DOCTORAL STUDIES**

As with Master’s studies, Doctoral studies may be undertaken part-time or full-time. All Doctoral studies are based on a research project, and no equivalent to the coursework Master’s degree is offered.

A Doctoral degree requires the successful completion of a research project on an approved subject, under the guidance of a supervisor who is an expert in the subject field, and the submission of a thesis based on the research undertaken by the student. A requirement of a
Doctoral degree is that the research conducted must make a substantial original contribution to the knowledge of and insight into the respective subject field.

Students may register for Doctoral studies before the end of March for the first semester or before the end of Augustus for the second semester.

All students are expected to maintain regular contact with their supervisors. All theses are assessed by at least three external examiners from other universities. No percentage mark is awarded to a thesis and the degree cannot be obtained with distinction. Upon submission of a thesis for examination, a prospective Doctoral graduate will submit to his/her supervisor at least one publishable manuscript, in the format required by an accredited journal, for that specific discipline as a condition for graduation. Authorship of such a paper/article must be guided by UJ Guidelines on Authorship. Faculty regulations will stipulate under which conditions students may be exempt from needing to submit such manuscripts.

**BURSARIES**

Various bursaries are available for postgraduate studies in the Faculty. Information about bursaries may be requested from the Dean’s office in the Faculty of Science or from the Postgraduate Office of UJ 011 559 4148/4530/6925.

**COURSE FEES**

The University determines course fees annually. Information about course fees may be requested from the Dean’s office in the Faculty of Science or the website of the University.

**PERIOD OF STUDY AND PASS REQUIREMENTS**

Refer to the Faculty’s Postgraduate Rules and Regulations for Honours, Master’s degrees and Doctoral studies.
Academy of Computer Science and Software Engineering

The Academy of Computer Science and Software Engineering aims to provide quality training in the field of information technology (IT). The Academy’s success record over the last 30 years proves that a good balance is maintained between the Academy and the industry. Students who obtain postgraduate qualifications with us are sought after in the industry and find work easily, both locally and internationally. Many former students are currently occupying top positions in various South African organisations.

This Department not only has some of the country’s top academics, but also some of the best computer laboratories in which a variety of research projects are currently in progress. A large variety of software and hardware is made available to students for research purposes.

The strong support from industry is evident in the many strong relations with companies such as Standard Bank, Microsoft, KPMG, Nedbank and CSIR. It is important to us to keep abreast of the industry’s needs.

More information is available at www.uj.ac.za/csweb

Honours: Computer Science, Informatics and Information Technology

An Honours degree in Computer Science, Informatics or Information Technology is regarded by many as a necessary qualification before taking up a position in the industry.

Admission Requirements for Computer Science

- An average of at least 60% for the final study year of Computer Science.
- The mathematical ability to understand advanced algorithms and to apply them in problem solving.
- The insight to design algorithms for implementation in a computer system.
- The ability to program and implement algorithms in a recognised computer language.
- Insight into the representation of data structures in a computer system and how data models work.
- A broad insight into the latest developments in the IT industry.
- A broad insight into the role and meaning of IT systems in modern society.

Admission Requirements for Informatics

- An average of at least 60% in the final study year of Informatics.
- The ability to identify a business problem in practice and to develop a computer system to solve it.
• Insight into the architecture of IT systems, including computers and networks.
• Insight into the representation of data structures in a computer system and how databases work.
• Insight into the use of IT network systems and the execution of electronic trade transactions.
• The ability to design websites for the Internet to serve as interfaces for electronic systems.
• Broad insight into the latest developments in the IT industry.
• Broad insight into the role and meaning of IT systems in modern society.

Admission Requirements for Information Technology

• An average of at least 60% for the final study year of Computer Science or Informatics.
• A BSc 310/ BSIT01 degree.
• The mathematical ability to understand advanced algorithms and to apply them in problem solving.
• The insight to design algorithms for implementation in a computer system.
• The ability to program and implement algorithms in a recognised computer language.
• Insight into the representation of data structures in a computer system and how data models work.
• A broad insight into the latest developments in the IT industry.
• A broad insight into the role and meaning of IT systems in modern society.

Course Content

The Honours courses are regularly adapted to keep abreast of the latest developments in IT. Some of the courses offered include:

• Information Security Governance
• Compiler Construction
• Service Computing
• Computer Forensics
• Biometrics
• Mobile Programming
• Systems Programming
• Parallel Programming
• Critical Information Infrastructure Protection
• Information Security
• Information Security in the WWW
• Software Factories
• IT Project Management
• Data Communications
• Ethical and Legal Aspects of IT
• Artificial Intelligence (AI)
• Graphics
• New Systems Development Paradigms
• Network Information Security
• Information Security Risk Analysis
• Project

Honours courses are presented in English. With the permission of the Head of Department, it is also possible to include modules from other study fields. Students are given the opportunity to do a more interdisciplinary Honours course.
Contact Time
- All Honours modules have a minimum of 18 hours formal lecture contact time.
- Lectures are offered during the late afternoon.
Please refer to the Academy’s Honours Brochure for particulars.

Duration
- Full-time – nine modules in one year.
- Part-time – four/five modules per year over two years.

MASTER’S STUDIES
A Master’s degree gives you the opportunity to focus on a single area and in so doing become an expert. Many organisations require a Master’s degree for senior positions.

Admission Requirements
- An Honours degree in Computer Science/ Informatics/ Information Technology with at least a 60% average.
- The selected topic must fall within the research field of one of the Academy’s staff members.

Admission is continuous.

Course Content
A Master’s degree in the Academy is entirely dissertation based with no lectures. Students choose the topic that they are interested in and work one on one with their supervisor. Some of the Master’s research projects recently undertaken include:

- Critical Information Infrastructure Protection
- Malicious Software and viruses
- Security of Virtual Systems
- Models for Digital Forensics
- Finger vein recognition
- Service Computing
- Agent-based Crowd Simulation
- Immunological Agents

Expectations
- Successful students must submit at least one article for publication before completing the course.

DOCTORAL STUDIES

Admission Requirements
Admission to a Doctorate is subject to the approval of the Head of Department.
For further information and duration of studies, see General Information.
APPLIED CHEMISTRY

The Department offers postgraduate programmes at Masters (MSc and MTech) and Doctorate (PhD) levels in Chemistry. Research in the Department is mainly focused on six areas namely: Nanomaterials Science Research which is an NRF recognized niche area and is also part of the Centre of Excellence for Strong Materials (CoE-SM) established by the Department of Science and Technology, Water Research which is part of the UJ Water and Health research unit, Analytical / Environmental Chemistry, Electrochemistry, Phosphorus Chemistry and Computational Chemistry Research.

The postgraduate community in the Department consists of both local and international students. All students registered in the Department have to give regular seminar presentations to staff and fellow students.

Nanomaterials Science Research

This research group forms part of the Centre of Excellence in Strong Materials established by the NRF and the Department of Science and Technology. The research group focuses on the synthesis, functionalisation, characterisation and applications of carbon-based nanomaterials. The main focus is on carbon nanotubes, which exhibit novel physical and chemical properties due to their nano size. For example, carbon nanotubes are the strongest material known and they are used in applications ranging from composites as fillers in polymers and membranes to electronics as components in the electronic industry (including, nanotransistors and nanowires). Much of the research in this group is multidisciplinary and our postgraduate students gain wide range of experience ranging from synthetic techniques to
electron microscopic characterisation. Other projects involve greener methods using microwave irradiation to synthesize nanocomposites materials incorporation doped carbon nanotubes and other metal nanoparticles.

**Nanocomposite membranes**
Activities in this area include fabrication and functionalization of commercial and in-house synthetic microfiltration-, ultrafiltration, nanofiltration and reverse osmosis membranes. The membranes are applied for removal of inorganics, organics and degradation of microbes in water. For degradation of organics and microbes in water, the membranes are impregnated with nanoparticles catalytic oxidation of organic compounds to convert them to less harmful products.

**Electrospun nanofibers**
The research activities involve electrospinning of synthetic and biopolymer solutions under applied voltage to produce nanofibers. The starting materials are synthetic- and biopolymers. The nanofibers are used as filters for removal of both inorganic and organic pollutants in water purification.

**Ceramics and nanomaterials**
The prime research domain in this field is the development of silicon/carbon nanomaterials from carbonaceous waste material using sol-gel technology. These wastes include lignin, low-value coals, coal ash, medical waste, and polymers. The nanocomposite materials are then used for various applications.

**Composites/Nanocomposites**
Polymer composites and nanocomposites are widely used in the diversified area of material science. It has also been used to develop high energy thermal and packaging devices. The research focus in this division of nanomaterial research has been expanded to include the application of these composite/nanocomposites in the removal of heavy metals and organic pollutants based on adsorption chemistry.

**Phosphorus Chemistry Research**
The phosphorus chemistry research activities cover synthesis and biological evaluation of new bisphosphonate derivatives as anti-tumour and anti-viral agents. The bisphosphonate derivatives are important because of their anti-metastatic activity in cancer patients and their antiviral activity against HIV-1, HIV-2 and other retroviruses. Current projects focus on phosphorylation of single-walled and double-walled carbon nanotubes. The phosphorylated carbon nanotubes have also been applied in the treatment of radioactive waste and in the removal of toxic metal ions. Currently the Department has joint anti-cancer research projects with the radiopharmaceutical unit at NECSA (Nuclear Energy Corporation of South Africa).

**Water Research**
The water research group is part of the newly approved NRF Niche Area at the University of Johannesburg, namely the Water and Health Group (UJWHG). There are two main thrusts in the water research field. One focuses on the use of nanoporous polymers (alias nanosponges) for removing organic pollutants in water purification. The activities involve the synthesis of water-insoluble cyclodextrin- and calixarene-based polymers and their derivatives and testing of various forms of the materials, a collaborative with the industry partners, to remove organic pollutants. Nanosponges bind organic molecules in aqueous media, but release
the same contaminants in organic media, which makes them ideal not only for this application but for chromatography, separation science, and for potential sensor applications. The UJWHG is a unique multidisciplinary organisation that involves engineering, health, and social science disciplines.

**Analytical/Environmental Chemistry**

Research activities in this area include sample preparation comprising of sample clean-up, pretreatment and preconcentration strategies to improved detection limits for applications in trace analysis; fabrication and surface modification of synthetic resins using molecular and ionic -imprinted polymers; supported and hollow fiber liquid membranes for water purification by removing metal ions, inorganics and organics substances; development of passive in situ and integrative samplers. Analytical activities include water analysis for persistent organic pollutants, cosmetics ingredients for quality check; drug residues in edible products; pharmacology of bioactive compounds; primary and secondary metabolites from plant sources. Method development for optimization of analyte detection; organic substances e.g cyanobacterial toxins including hepatotoxins, lipopolysaccharide (LPS) endotoxins, neurotoxins and saxitoxins (paralytic shellfish toxins, PST). The analytical techniques include chromatographic and mass spectrometric techniques (GC, LC, GC-MS and LC-MS). Analysis of inorganic contaminants mainly heavy metals and other oxyanions; chemical speciation studies of heavy metals in drinking water and wastewater from industrial effluents, techniques for speciation analysis include electrochemical, spectrometric & chromatographic methods; IC-ICP-OES and LC-ICP-MS.

**Electrochemistry Research**

The electrochemistry research in the Department focuses on the following:

- Electrochemical sensors and biosensors based on nanocomposite (dendrimer, gold nanoparticles, graphene and quantum dots) platforms for biomedical, water and environmental applications.
- Photoelectrochemistry: i) synthesis and photo/electro-characterisation of novel photoactive composite materials such as graphene, graphite, polymers/dendrimers, and other nanomaterials; ii) development of reactors for water treatment
- Application of electrochemistry in the analysis of organic, inorganic and natural products.

Current research involves development of chemical sensors for selected organic and inorganic water pollutants, aptamer biosensor for HIV protein detection, cholera biosensor, smart polymer based enzyme biosensors, exfoliated graphite based photoelectrochemical reactors for the removal of organics from water (water treatment), onsite electrochemical sensor for arsenic, among other metals.

**Computational Chemistry**

Computational Chemistry is but one component from many that contributes to the world of Science. This particular science allows chemists to study and solve complex, challenging or unobserved chemical phenomena by running calculations on computers based on
computer science and mathematical techniques. The areas computationally investigated include material science i.e. nanotechnology, biopolymers and crystallography; environmental sciences; reaction conditions such as kinetics and mechanisms. Thermodynamics and structure-property-activities of compounds that are important to the environment are explored; life sciences such as molecular biology, genomics, proteomics and medicinal chemistry e.g. pharmacology. Current research in computational chemistry includes simulation studies of Vitamin B12 analogues. Vitamin B12 and its analogues are unique because of the organometallic bond it contains. The two bioactive forms of vitamin B12, Methylcobalamin and Adenosylcobalamin, have intrigued chemists for many years because of their different behaviour in an enzymatic environment. Gaussian 09 software, various visualisation programs (GaussView, ChemCraft, HyperChem and Mercury) and the computer clusters based at the Centre of High Performance Computing (CHPC) is extensively used to comprehensively explore factors that affect the reactions of Vitamin B12 analogues under different environmental conditions.

Research Funds
Research funding currently in the Department is through UJ Faculty Research committee, National Research Foundation, Water Research Commission, Eskom, Sasol, the Department of Science and Technology (DST) through the Centre of Excellence for Strong Materials, Nanotechnology Innovation Centre (NIC) and through bilaterals between the researchers in the Department and international collaborators. Students benefit from this funding in the form of bursaries and project running cost.

Research Facilities
Our laboratories are equipped with a number of facilities that include a range of chromatography instruments such as GC instruments coupled to various detectors namely, MD, NPD, FID, EDC, as well as GC-MS/MS with both EI and CI capabilities; Autotrace solid phase extractor, total organic carbon analyzer, electrochemical and photoelectrochemical workstations; various instruments for manufacturing nanomaterials including a chemical vapour deposition tube furnaces and a high-speed ball-mill. Surface and chemical characterisation of materials is done at UJ campuses using, FTIR, IC, AAS, ICP-OES, and HPLC, TGA, TEM, SPM, and AFM. Other facilities are also available at Wits University, CSIR-Pretoria, Mintek, Johannesburg Water among other institutions. These include C13-NMR, Electron microscopes, Raman spectroscopy, Crystal and Power analysis with crystallography and XRPD, respectively.

MASTER PROGRAMMES:
1. MTech and MSc in Chemistry

Admission Requirements
MTech: A BTech in Chemistry or an equivalent qualification as determined by a status committee.
MSc: A BSc-Honours degree or an equivalent qualification as determined by a status committee.

Closing Date
Before the end of February for the first semester or before the end of August for the second semester.
Course Content
The programme is a research-based study in an approved field. The maximum period is two years full-time and three years part-time. Students are expected to submit a dissertation which is examined both internally and externally.

2. MSc in Nanoscience
The Department of Applied Chemistry coordinates the Masters degree programme in Nanoscience and Nanotechnology which is offered by a consortium of four South African universities namely University of Johannesburg, Nelson Mandela Metropolitan University (NMMU), University of the Free State (UFS) and the University of the Western Cape (UWC).

Admission requirements
An average mark of 60% in BSc-Honours or BTech in the fields of Biomedical, Chemistry, Physics or related science and technology fields of Biosciences, Chemical sciences and Engineering. The programme is open to South African citizens only but management may consider students who are permanent residents in South Africa if the required number of South African students is not met. This is only done on a once off basis.

Course Content
Students take two compulsory core modules to introduce them to the fundamentals of Nanoscience and also to management and entrepreneurship. Students also do two non-major introductory courses in each of the two fields which differ from their own study field. Students then proceed to do one major advanced course in their own study field. For example: Chemistry students take advanced courses in nanochemistry while Physics students do advanced courses in nanophysics, etc. The students also take a compulsory module in Instrumentation in Nanoscience. All the course components are presented at UWC and lecturers from all the four universities participate in the courses. The duration of the course component is nine months. The course component is weighted at 40% and the research project is weighted 60%.

Research Component
On completion of the coursework at UWC in September, the students return to UJ where they do a research project under a local supervisor. The duration for the research project is 15 months.

Funding
This programme is fully funded by the Department of Science and Technology (DST).

DOCTORAL STUDIES
Admission Requirements
• Admission to a Doctorate program is subject to the approval of the Head of Department.
• For further information and duration of studies, see General Information.

For all the degrees, enquiries must be made through the Head of Department, who will refer the application to the academic staff specialising in the field of interest.

RESEARCH CENTRES IN THE DEPARTMENT
Nanotechnology Innovations Centre through DST/ Mintek
The DST/Mintek Nanotechnology Innovation Centre (NIC) is a national facility that is geographically spread
across the country and was established at Mintek in 2007 by the Department of Science and Technology. The Mintek NIC activities are aimed at addressing national priorities highlighted by both the national nanotechnology strategy and national research and development (R&D) strategy. Through the DST/Mintek/NIC, collaborative networks have been established locally, allowing various Universities such as the University of Johannesburg, University of Western Cape, University of Witwatersrand and Rhodes University. UJ, Department of Applied Chemistry is the DST/Mintek/NIC node focusing on Nanotechnology and Water Treatment. The core business is to produce enhanced performance of membrane systems for water treatment. The DST/Mintek/NIC sponsors postgraduate students, provides running cost and equipment to support research activities by various staff members in the Department.

Centre for Nanomaterials Science
The Research Centre for Nanomaterials Science housed by the Department of Applied Chemistry at the University of Johannesburg is a multi-disciplinary team focused on the synthesis, characterization and application of nanomaterials. The Centre has many researchers working in this field who are supervising postgraduate students. The projects funded through the Centre broadly fall under the following four basic themes:

- Nanomaterials for Water Treatment
- Composites/Nanocomposite for waste water application
- Nanomaterials for Sensor and Photovoltaic Applications
- Bio-nanomaterials for medicinal and environmental applications

The overall research focus is the synthesis, characterisation and application of various nanomaterials to energy, water, catalysis, medicine and materials applications. In particular there is a strong emphasis on carbon-based materials such as carbon nanotubes, nanofibers, and nanospheres, including carbides and organic polymer-based materials.
APPLIED MATHEMATICS

The postgraduate programme in the Department aims to enable students to solve a wide series of actual problems through mathematical modelling. Their training comprises three elements: education in important basic mathematics, a background in selected areas of application, and scientific computing. All three elements are fully developed in the Honours programme, which deals with Differential Equations (basic mathematics of general interest), Dynamic Systems (a very important field of application) and Computer Algebra (development of formal mathematical software).

The Department undertakes research and presents courses on Scientific Computing, which is a fast-growing interdisciplinary field that integrates mathematical analysis with scientific models in such a way that a whole new scientific way of thinking is constituted. (This field should, however, not be confused with Computer Science, in which the computer is the subject of study.) Scientific Computing includes the following aspects: Numeric and Symbolic Analysis, High-Performance Software and Mathematical and Engineering Software. Almost all the fields of science and engineering use computers for Mathematical Modelling and Problem Solving, thus requiring skills in this field. Research in the Department comprises projects in Quantum Calculations, Nonlinear Dynamics, Deterministic Chaos, Fractals, Wavelets, Cellular Automata, Neural Networks, Genetic Algorithms, Numeric Analysis, Symmetry Solutions of Differential Equations, Computer Algebra and Software and Hardware Development.

The Department collaborates with the ETHZ in Zurich, Switzerland on Neural Networks and Neurocomputation and with the National University of Singapore on Scientific Computing and Computer Algebra.

Students with postgraduate qualifications in Applied Mathematics are highly in demand, especially to work for employers for whom Mathematical Modelling is important. This is the case in the financial sector in particular, where most of the postgraduate students of the Department are employed as quantitative analysts.
HONOURS

Admission Requirements
• A Bachelor’s degree with Applied Mathematics as one major.
• An average mark of at least 60% for third-year Applied Mathematics modules.

Postgraduate Courses
• Lie Groups and Lie Algebra
• Relativity
• Dynamic Systems
• Quantum Field Theory
• Multilinear Algebra
• Differential Equations
• Advanced Scientific Computation and Programming
• Neural Networks
• Computer Algebra
• Quantum Computation
• Numerical Analysis
• Compulsory Project

Expectations
• Students should pass all modules at the first attempt.
• Students must make one presentation based on the project.

Contact Time
One 90 minute lecture per module per week.

Duration
One year full-time or two years part-time.

MASTER’S STUDIES

DISSERTATION-BASED MASTER’S STUDIES

Admission Requirements
• An Honours degree in Applied Mathematics.
• An average of at least 60% in the Honours course.
• A suitable supervisor must be available.
• Content of degree studies
• A dissertation and such additional work as prescribed by the Head of the Department.

DOCTORAL STUDIES

Admission Requirements
• Admission to a Doctorate is subject to the approval of the Head of Department.
• For further information and duration of studies, see General Information.
BIOCHEMISTRY

Biochemistry is the study of life and living systems with the help of chemical, physical and biological methods.

“The modern history of the human race is full of remarkable and admirable (and some not so admirable) achievements in the areas of science, engineering, medicine, agriculture, communications, space exploration, social progress, economics, and the arts. The future will certainly record many more. However, of all the progress that is anticipated, the greatest impact may result from the quest to learn how a living organism operates in terms of the molecules that compose it, and then to manipulate the molecules and thus manipulate the organism. A profound statement to say the least, but yet this is the real prospect for the future. The core of this quest is biochemical knowledge.” - R.C. Bohinsky

Growing international collaboration and excellent teaching have become hallmarks of UJ’s Biochemistry Department. The Department boasts an 80% staff complement with PhD degrees, with the remaining members registered for PhDs and at various stages of completion.

Research activities in the Department are varied and include aspects of plant-, mammalian- and microbial biochemistry. Students are thus exposed to a wide range of topics and different approaches in modern Life Sciences research. Research fields include Human Genetics and Infectious Disease, Molecular Plant:Microbe Interactions, Cancer, Diabetes Therapeutics, Chromatin Structure and Function, Microbial Enzymes, Plant Disease and Molecular Plant Pathology.

Irrespective of the field of qualification, students can work in various disciplines. There are numerous career possibilities in the following fields:

• Forensic sciences
• Medical research, pathology and health services
• Environmental management and water quality
• Biotechnology
• Agricultural sciences and crop protection
• Natural sciences
• Pharmaceutical industry
• Education and training
• Biochemical/chemical corporate industry
HO

Admission Requirements
• A Bachelor’s degree with Biochemistry as a major and a minimum of 65% for Biochemistry 3.
• Molecular Biology should form a component of the undergraduate studies.

Closing Date
Application forms and the relevant closing date are published on our web site at http://www.uj.ac.za/EN/Faculties/science/departments/biochemistry/Pages/default.aspx.

Course Content
• Advanced Analytical Techniques
• Protein Biochemistry
• Advanced Catalysis and Enzyme Technology
• Current Advances in Biotechnology
The course also includes an extended practical component, in which students conduct an individual, supervised research project in one of the Department’s research fields.

Expectations
• Students must be motivated, have perseverance and be willing to work with external organisations.
• Students are expected to attend our two-weekly Departmental Journal Club, during which students will contribute by presenting a research proposal, results or research paper.

Contact Time
• 08:00 – 17:00
• Formal lectures and practicals are presented according to a timetable.

• Lectures constitute about six hours per week and practicals comprise twenty-four hours per week.

MASTER’S STUDIES
Admission Requirements
An Honours degree in Biochemistry with Molecular Biology as well as an acceptance letter by an academic staff member in the Department.

Closing Date
End of August if students require an NRF bursary. Otherwise, applications must reach the Head of Department before the end of November for consideration.

Content of Degree Studies
Students perform supervised research in one of the Department’s research fields. These include:
• Human Genetics and Infectious Disease
• Molecular Plant:Microbe Interactions
• Cancer
• Diabetes Therapeutics
• Chromatin Structure and Function
• Microbial Enzymes
• Plant Disease and Molecular Plant Pathology

Expectations
• Students must be motivated, be able to work independently and have perseverance.
• Master’s students work mostly on their own research projects.
• Master’s studies comprise a supervised research project with a dissertation.
• The results of the project must also be presented orally to an audience.
• Regular participation in the Journal Club is compulsory.
• An article for publication must be submitted.

**Supervisor**
• The supervisor is selected according to the choice of study field.
• The supervisor determines the study field and research project in consultation with the student.

**DOCTORAL STUDIES**

**Admission Requirements**
• A Master’s degree in Biochemistry/Molecular Biology. Admission to a Doctorate is subject to the approval of the Head of Department.

**Closing Date**
End of August if students require an NRF bursary. Otherwise, applications must reach the Head of Department before the end of November for consideration.

**Content of Degree Studies**
Students perform supervised research in one of the Department’s research fields. These include:
• Human Genetics and Infectious Disease
• Molecular Plant:Microbe Interactions
• Cancer
• Diabetes Therapeutics
• Chromatin Structure and Function
• Microbial Enzymes
• Plant Disease and Molecular Plant Pathology

**Expectations**
• Students must be motivated, be able to work independently and have perseverance.
• PhD students work on their own research projects.
• PhD studies comprise an extended supervised research project with a thesis.
• The results of the project must also be presented orally to an audience.
• Regular participation in the Journal Club is compulsory.
• An article based on the work must be accepted for publication prior to submission of the thesis.

**Supervisor**
• The promoter is selected according to the choice of study field.
• The promoter determines the study field and research project in consultation with the student.


[BiochemistryUJ](http://www.uj.ac.za/EN/Faculties/science/departments/biochemistry/default.aspx)
BIOTECHNOLOGY

Biotechnology is an industrially oriented course. It deals with the use of living cells or their enzymes to man’s advantage. It involves the microbiology, biochemistry, fermentation and genetics that are associated with these processes.

As a trained graduate in this dynamic and exciting field, biotechnologists have a variety of industries in which to seek employment.

BTECH

Upon completion of the Diploma in Biotechnology, an additional year of study may be completed, currently known as the BTech in Biotechnology. The BTech provides an intensive theoretical and practical integration of sophisticated techniques including plant tissue culture and cloning of DNA in bacteria.

Admission Requirements

- A Diploma in Biotechnology or an equivalent qualification.
- Major subject – average 60%.

Closing Date
End of August.

Course Content

- Plant Biotechnology 4
- Research Projects 4
- Research Methods and Techniques
- Entrepreneurial Skills
- Industrial Biotechnology 4
- Microbial Biochemistry 4
- Recombinant Technology 4

Expectations

Students must:

- Be motivated.
- Have perseverance.
- Attendance of a Journal Club programme is compulsory, and students must present their mini-projects during this programme.

Working Hours

- 08:00 – 17:00.
- Formal lectures and practicals are presented according to a timetable.
- Lectures for the full-time course constitute about 18 hours per week and practicals about 12 hours per week. The part-time programme hours are half of those of the full-time one but the part-time programme is offered over two years compared to one year in the case of full-time studies.

Duration

One year, full-time
MTECH

Admission Requirements
BTech in Biotechnology or equivalent qualification.

Closing Date
End of August.

Course Content
A research project and a dissertation in a suitable field in Biotechnology.

Expectations
• Students must be motivated.
• Students must be able to work independently.
• Master's studies comprise a supervised research assignment with a dissertation.
• The results of projects must also be presented orally to a suitable audience.
• Regular participation in the Journal Club is compulsory.
• At least one article published in an accredited journal

Supervisor
• The supervisor is selected according to the choice of study field.
• The supervisor/promoter determines the study field and research assignment in consultation with the student.

DTECH

Admission Requirements
MTech in Biotechnology or equivalent qualification.

Closing Date
End of August.

Course Content
A research project and a dissertation in a suitable field in Biotechnology.

Expectations
• Students must be motivated.
• Students must be able to work independently.
• Doctoral studies comprise novel research.
• The results of projects must also be presented orally to a suitable audience.
• At least one article published in an accredited journal
• Regular participation in the Journal Club is compulsory.

Supervisor
• The supervisor is selected according to the choice of study field.
• The supervisor/promoter determines the study field and research assignment in consultation with the student.
Plants are essential to the lives of humans and animals, directly or indirectly providing all our food. They also act as carbon sinks, producing nearly half the oxygen required for life on earth. With a global changing environment and an exploding world population the genetic modification of crop plants, discovery of new pharmaceuticals, solutions to problems of global warming, conservation of our biodiversity and food security are important aspects that all depend on botany. Botany at the UJ is presented in an innovative way by dynamic staff. The emphasis is on the greater demands made by the ever-changing needs of a growing world and local population. The staff in the Department are leaders in their fields, covering a variety of subject disciplines.

At postgraduate level emphasis is placed on Plant Taxonomy and Plant Growth and Development.

**Plant Growth and Development**

The main thrust of research in this field is in the areas of plant biotechnology and postharvest physiology and technology of fresh fruit, vegetables and cut flowers. Every role player in the fresh produce industry must have a good working knowledge of all the factors affecting the deterioration and quality of the product. Such knowledge is essential to ensure the delivery of prime-quality produce on the local and export markets and to minimise postharvest losses. In addition, researchers are also involved in the local industry and provide a regular consultation and training service to
various role players in all sectors of the industry. Research in the area of plant biotechnology is aimed at crop protection to meet the ever-increasing challenges facing crop production in our country. The researchers at the Department of Botany are experts in these areas, and the results of their research are widely published in international journals and presented at national and international symposia and conferences.

**Taxonomy, Medicinal Plants and Ethnobotany**

The Department is widely known as a centre of excellence in the field of African medicinal plants, ethnobotany and the classification of African plants. During the past decade, the research of the UJ taxonomy group has led to the publication of numerous research articles and books, as well as the presentation of various papers at national and international conferences and the registration and patenting of new pharmaceutical products. A number of new genera and new plant species have been identified and described by our taxonomists. One of aims of their taxonomic endeavour is to investigate the genetic, chemical and geographical variations in various commercially important indigenous plants, especially those that are potentially useful to the pharmaceutical industry. In addition, the members of our molecular plant systematics team are leading world experts in the barcoding of plants. Taxonomic research at the UJ is done in collaboration with leading researchers in countries such as Germany, the UK, Australia and the USA. Students are well equipped to contribute to the South African economy and society by keeping a healthy balance between academic excellence and the practical application of botany. The choice of professions and career opportunities offered by Botany is unlimited. Humans depend on plants for the provision of food, medication, clothing, housing, a pleasant aesthetic environment, recreation and much more. Therefore, botanists play an important direct or indirect role in providing us with our everyday needs and ensuring our general welfare.

**HONOURS**

**Admission Requirements**

- Admission to the Honours course is subject to the approval of the Head and academic members of the Department.
• A degree with Botany as major and at least 60% in Botany 3.

Closing Date
End of November.

Course Content
The course consists of five sections that have to be passed independently and that are constituted as follows:
• A compulsory project.
• Modules in Postharvest Physiology; Advanced Taxonomy and Economic Botany; Plant Systematics and Molecular Evolution; Plant Biotechnology and Scientific Methods.
• Participation in departmental excursions may also be required.

The examination consists of written papers or assignments in each section. All sections carry equal weight and must be passed independently.

Expectations
Students must participate in the annual postgraduate symposium and in tutoring undergraduate students.

Contact Times
• Full-time students must spend at least eight hours per day in the Department.
• Lectures are presented according to a predetermined timetable.
• The practical project is undertaken on a continual basis.

Duration
One year full-time.

MASTER’S STUDIES

Admission Requirements
An Honours or four-year degree in Botany or a related field.

Closing Date
• Registration is according to the schedule in the academic calendar.
• Applications are considered throughout the year.

Expectations
Students must participate in the annual postgraduate symposium and in tutoring undergraduate students.

Content of Degree Studies
A dissertation on an approved research topic.

Contact Times
Full-time students must spend at least eight hours per day on research.

DOCTORAL STUDIES

Admission Requirements
Admission to a Doctorate requires a Master’s degree in botany or a related field and is subject to the approval of the Department.

Closing Date
• Registration is according to the schedule in the academic calendar.
• Applications are considered throughout the year.

Expectations
Students must participate in the annual postgraduate symposium and in tutoring undergraduate students.

Content of Degree Studies
A thesis on an approved research topic.

Contact Times
Full-time students must spend at least eight hours per day on research.
CHEMISTRY

Research in the chemical sciences conducted at University of Johannesburg focuses on synthetic methodologies, synthesis of biologically important molecules, catalysis, determination of molecular structures and the development and application of instrumental analytical techniques.

Synthetic Organic Chemistry

The research programme in synthetic organic chemistry focuses on synthetic methodologies of industrial and pharmaceutical interest. This research is directly associated with the well-established local petrochemical industry, which is an industry that offers well-qualified students excellent career opportunities. A very successful research programme in the field of carbonyl and olefin-based reactions, by means of palladium-catalysed reactions among others, is currently being undertaken in conjunction with SASOL. Another exciting project aims to synthesise a variety of antiviral compounds (e.g. against HIV and Herpes simplex viruses) making use of patented technology developed in-house at the UJ laboratories. Funding is obtained through the NRF, Mintek, Sasol and THRIP.

Inorganic Chemistry: Synthesis, Structure, Reactivity and Properties

The research program in inorganic chemistry at UJ’s Kingsway Campus focuses on the metals gold (Au) and copper (Cu), as well as the platinum group metals (PGMs) – especially platinum (Pt), palladium (Pd), rhodium (Rh), and ruthenium (Ru). These metals are of great economic importance to South Africa since more than 80% of the ores for them are found here. Apart from the unique physico-chemical properties of these metals, the elements and their compounds are also found in the most important catalysts developed in the past century. Gold and platinum also have important medicinal applications in commercially available drugs like auranofin (anti-arthritic) and cisplatin (anti-cancer), respectively.

The focus in this research group is aimed at the development of the fundamental and applied coordination chemistry of
these elements. Specific attention is given to the development of new selective ligands that find application in the use of gas sensors, ionic liquids, liquid crystals, luminescent compounds and catalysts. With the advent of the new well-equipped analytical facility, attention has also been given to the fabrication of inorganic materials that are ceramic or hybrid organic/inorganic in origin.

**Trace element Analysis**
Research projects focus on the development of analytical methodologies for and the application of a range of atomic spectroscopical techniques such as AAS, ETA-AAS, ICP-OES, ICP-MS, XRF and separation techniques such as HPLC and IC in the field of trace element analysis. One project investigates the feasibility of multi-element and isotope ratio analysis data obtained by ICP-MS combined with multivariate statistical analysis for provenance determination of South African wines and other agricultural products.

**Crystal and Structural Chemistry**
This program is concerned with the phase chemistry of industrially important materials, with the focus on the mineral and wax industries. The relationships between structure and properties of the crystalline forms of these materials are studied by the determination and analysis of their three-dimensional structures. The use of supramolecular techniques for the preparation of unique compounds is stressed. Current projects include:
- The determination of structural properties of selected organometallic catalysts.
- The synthesis and structural determination of zirconium sulphate hydrates as precipitating agents for amino acids and proteins.

**Equipment**
The Department of Chemistry has modern well-equipped laboratories and sophisticated research facilities such as advanced high-pressure reactors for synthetic work, a selection of spectrometers for structure determinations (mass spectrometers such as EI-MS and GC-MS, NMR, infrared spectrometers, X-ray diffractometer, and thermal analysis apparatus (DSC, TGA-MS), instrumentation for the study of surfaces (SEM, TEM, AFM, and zeta potentials), equipment for elemental analysis (ICP, ICP-MS with laser ablation, AAS, XRF, HPLC) and the necessary computer facilities and crystallographic databases for molecular modelling.

Collaboration with various universities and research institutes abroad (for example the University of Gent in Belgium, Hauptman-Woodward Institute in the USA) makes it possible for students to do part of their PhD studies at other leading laboratories. Agreements with local universities (Rhodes, North West, etc) ensure a local network for optimal use of expensive equipment.

**HONOURS**

**Admission Requirements**
A minimum of 60% in Chemistry at third-year level.

**Closing Date**
30 October

Written applications with a short CV and a comprehensive study record must be submitted to the Head of Department.
Course Content
Eight theoretical modules that cover modern areas in Chemistry
- Advanced organic chemistry: Reaction mechanisms
- Advanced organic chemistry: Creativity in synthesis
- Atomic Spectroscopy
- Instrumental Analysis
- Solid State Chemistry
- Organometallic Chemistry
- Quantum Chemistry and Spectroscopy
- Structural Chemistry
- Prescribed practicals in synthesis, analysis and structural determination.
- A short research project chosen from one of the research areas

Bursaries (for example)
- NRF
- SASOL
- Chemical Services
- UJ (Faculty and Department)

Expectations
- Students must be dedicated and motivated for a year of hard work. At the end of the year, a vast amount will have been learned and students will feel confident that they are now properly trained and fully-fledged chemists.
- Each of the eight modules must be passed separately. Attendance of lectures and practical work is compulsory. Participation in seminar programmes is expected. A project based upon current research in the Department will be carried out and all practical work has to be written up satisfactorily in a scientific report.
- Students are expected to act as demonstrators at undergraduate practicals as part of a student assistantship programme for which remuneration is received at an hourly rate.

Contact Time
- 8:00 - 17:00.
- Formal lectures are presented according to a timetable, which typically includes two-hour lectures four times a week.
- Practical laboratory work makes up the rest of the workday every weekday.
- Students are expected to act as demonstrators for at least three hours per week.

Duration
- One year of full-time study.
- In exceptional cases, applications may be made for the course to be completed part-time over two years, with four modules per year.

MASTER’S STUDIES

Admission Requirements
- A BSc-Honours degree or an equivalent qualification with Chemistry as a major, is a prerequisite, preferably with an average of at least 60%.
- Approval for admission to a particular study field requires consultation with and approval of the relevant research degree supervisor.
- Students may undertake their MSc degrees either full-time or part-time, at the discretion of the supervisor.
Closing Date
Applications for Master’s degree enrolment should preferably be submitted at the beginning of the academic year, but applications are also considered throughout the calendar year.

Content of Degree Studies
• For an MSc degree, students need to complete a research project in one of the specialisation fields listed above as research areas currently undertaken by the Department of Chemistry.
• Students need to show satisfactory progress in their experimental work for the duration of their MSc degree programme.
• The degree is conferred on successful completion of a written dissertation based on the subject and outcomes of the research.

Expectations
• Students are required to present research results at national and/or international conferences, as well as to participate in Departmental seminars.
• At least one peer-reviewed research publication is expected to follow from the results of the research performed for an MSc degree.

DOCTORAL STUDIES
Admission Requirements
• Admission to a Doctorate is subject to the approval of the Head of Department.
• For further information and duration of studies, see General Information.

FOOD TECHNOLOGY
Food Technology is the application of the branch of food science which deals with production processes to produce nutritious, wholesome food which is economically viable. It includes all aspects of food manufacturing, including selection, handling, refining, preserving, processing, packaging and distribution of food. It is a highly interdisciplinary applied science which incorporates concepts from many different fields including microbiology, engineering and biochemistry.

BTECH
There are two options of study in the BTech: a Food Product Development option and a Food Process Engineering option. More in-depth studying of modules including Food Technology, Food Microbial Assurance, Food Product
Development, Food Production and Food Components will equip the student with the ability to integrate and apply food science and technology principles in the manufacture of food.

**Admission Requirements**
A National Diploma in Food Technology or an equivalent qualification at an equivalent standard, as determined by a Status Committee, with appropriate bridging courses

**Closing Date**
End of August.

**Course Content**
The BTech may be undertaken on part-time (two year) or full-time (one year), depending on student numbers.

**Compulsory modules**
- Food Technology
- Food Microbial Assurance
- Research Methodology: Natural Sciences
- Food Production
- Food Project

**Food Production Option**
- Food Process Engineering
- Food Product Development or Food Components

**Food Product Development Option**
- Food Product Development
- Food Components

Projects can be conducted in the workplace by part-time students if approved by the Department.

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**MTECH**

**Admission Requirements**
BTech in Food Technology or an equivalent qualification at an equivalent standard as determined by a Status Committee and approved by the Faculty Board.

**Closing Date**
End of July.

**Course Content**
- The MTech may be undertaken full-time.
- The MTech is research-based and a dissertation on an approved research topic must be submitted.

**Expectations**
- It is expected of students to be innovative and to show ability to work independently.
- Regular participation in the Journal Club.
- Oral presentation of results.
- Preparation of an article for publication.

**Research Topics**
The research areas within the Department include cereals with an emphasis on baking and bread quality, mycotoxins and brewing and beverages (in collaboration with the Faculty of Engineering and the Built Environment). Students enrolling for a Master’s degree in this field will be eligible to apply for bursaries. Topics from other research areas which students have identified may be presented to the Department.
GEOGRAPHY, ENVIRONMENTAL MANAGEMENT AND ENERGY STUDIES

The Department of Geography, Environmental Management and Energy Studies operates a large postgraduate school in this field. Graduates from this Department are employed by government, provincial and municipal departments, engineering firms, mining houses, environmental consultants and business enterprises as researchers in various fields. On the other hand, many graduates successfully open their own consultancy businesses in the field of environmental management and geo-information science applications.

The following postgraduate qualifications are presented by this Department in the Faculty of Natural Science:

- Honours, Master’s (research) and Doctorate in Geography
- Master’s (coursework) and Doctorate (research) in Environmental Management
- Honours, Master’s (research) and Doctorate (research) in Energy Studies.

HONOURS IN GEOGRAPHY

Admission Requirements

- For admission to the Honours course, a Baccalaureus degree with Geography as one major (65% average in third year) is required.
- Admission to the Honours course is subject to the approval of the Head of Department.

Closing Date

The closing date for applications is the end of October, but ad hoc applications may be considered until mid-January.

Course Content

The course consists of five semester modules of which Module 3 (Philosophy and Methodology) and Module 7 (Research Project) are compulsory. Examination is at the end of the semester of presentation for theory modules and at the end of the year for the research module. Module 3 and every other semester module must be passed independently (50%) in order to continue with study towards the Honours degree.
The following semester modules can be considered. However, the modules to be presented as electives in a particular year of study are determined annually:

- Philosophy and Methodology of Geography as a Science (compulsory)
- Geo-informatics 1: Geographic Information Systems (elective)
- Geo-informatics 2: Remote Sensing and Image Processing (elective)

(Note: Geo-informatics 1 & 2 can also be taken for non-graduate purposes as postgraduate certificate qualifications).
- Tourism Geography, Economic Geography, Urban Geography, Geomorphology (electives)
- Strategic Environmental Planning (elective)
- Energy Technology (elective)
- Research Project (compulsory)

The possibility of an option of one approved Honours semester course other than Geography may also be considered, e.g. from Zoology, Geology and Botany.

Expectations

- Students must be motivated.
- Students must be able to conduct intensive self-study and come to class well prepared.
- Students must participate in class discussions.
- Students (part-time and full-time) must attend all lectures.

Contact Time

Lectures are presented according to a predetermined timetable. This programme is only presented on a full time basis.

Duration

Full-time (one year).

MASTER'S DEGREE IN GEOGRAPHY

The Master's degree in Geography comprises of a research-based dissertation, which must be completed under the guidance of an appointed supervisor.

Admission Requirements

For admission to the Master's degree in Geography (MSc), an Honours Baccalaureus degree in Geography is required. However, an Honours BSc-degree in a subject other than Geography will also be considered, provided that Geography was taken as a major for the BSc-degree. In the latter case, candidates must successfully complete the following two modules of the Honours course in Geography, over and above applicable additional study that may be required:

- Philosophy and Methodology of Geography as a Science (Module 3), and
- Any other related module of the Honours course in Geography.

Admission to the research Master's is subject to the approval of the Head of Department.

Closing Date

Normally March and July of each academic year, but late registration will be considered on an ad hoc basis.

Course Content

Students choose a research topic in collaboration of the Head of Department, and approved by the Faculty of Science, which must be completed within two years (full-time) or three years (part-time).
Expectations
• Students must be motivated.
• Students must be able to prove that they can conduct independent research.
• Students must be able to write a scientific report.

DOCTORATE IN GEOGRAPHY

Admission Requirements
• For admission to the Doctorate in Geography (PhD), a Master’s degree in Geography is required.
• The Head of Department approves admission to the Doctorate in Geography.
• For further information and duration of studies, see General Information.

MASTER’S IN ENVIRONMENTAL MANAGEMENT

Admission Requirements
• For admission to the coursework Master’s programme in Environmental Management (MSc or MPhil), an Honours degree in Geography or any four-year equivalent degree is required.
• The duration of the coursework Master’s is 24 months (4 semesters) maximum for full-time students, and three years (6 semesters) maximum for part-time students.
• Admission to the Master’s programme in Environmental Management is subject to the approval of the Head of Department.

Closing Date
Please note that the closing date for applications is the end of September of the year prior to study, with a limited number of intakes annually.

Course Content
The coursework Master’s in Environmental Management consists of three modules, two of which consist of course-work examination papers, namely:
• Module 1: Biosphere and Environmental Studies
• Module 2: Environmental Analysis and Management
• Module 3: Minor-dissertation (50% of final mark).
Expectations
• Students must be motivated.
• Students must be able to conduct intensive self-study and come to class well prepared.
• Students must participate in class discussions.
• Students must be able to conduct research and to write a scientific report.

Contact Time
One afternoon per week (normally Wednesdays) starting at 15:00 and some Saturdays as specified by the course coordinator.

DOCTORATE IN ENVIRONMENTAL MANAGEMENT

Admission Requirements
• For admission to the Doctorate (PhD) in Environmental Management, a Master’s degree in Environmental Management is required. However, as a result of the interfaculty nature of Environmental Management, another relevant and equivalent Master’s qualification may also be considered.
• The Head of Department approves admission to the Doctorate in Environmental Management.
• For further information and duration of studies, see General Information.

HONOURS IN ENERGY STUDIES

Admission Requirements
Admission to the course requires the approval of the Head of Department and the programme co-ordinator and is subject to appropriate undergraduate studies and experience in the energy industry.

Closing Date
The final date for application for the Honours programme in Energy Studies is at the end of November annually for study the following year.

Course Content
The course comprises the following SIX semester compulsory modules, of which the first five are compulsory. There are written examinations for each the five theory modules
• Energy Economics
• Energy Technology
• Energy Modelling
• The International, Geographical and Political Aspects of Energy
• Energy Policy Formulation
• Compulsory Research Project

Expectations
• Students must be motivated.
• Students must be able to conduct intensive self-study and come to class well prepared.
• Students must participate in class discussions.
• Students must attend all lectures.

Contact Time and Duration
The course is only presented part-time (4 semesters) at a time as arranged by the programme co-ordinator (usually once per month on Thursday afternoon and evening, Friday all day, and Saturday morning).
MASTER’S IN ENERGY STUDIES

Admission Requirements

• Admission to the Master’s (MPhil) in Energy Studies preferably requires an Honours degree in Energy Studies, although a student with Honours in a related subject, together with appropriate experience in the energy industry, may be considered for admission. In the latter category, students may to register for, and successfully complete, one or more of the modules for the Honours course in Energy Studies.

• Admission to the Master’s in Energy Studies is subject to the approval of the Head of Department.

Closing Date
End of February or end of Augustus of each academic year, however late registration will be considered on an ad hoc basis.

Course content
A research dissertation on a study fields, chosen after consultation with the Head of the Department is required for the Master’s degree, and must be completed within two years (full-time) or three years (part-time).

Expectations

• Students must be motivated.

• Students must be able to prove that they can conduct independent research.

• Students must be able to write a scientific report.

DOCTORATE IN ENERGY STUDIES

Admission Requirements

• Admission to the Doctorate (PhD) in Energy Studies preferably requires a Master’s in Energy Studies, although a student with a Master’s degree in a related subject, and with appropriate experience in the energy industry, may be considered for admission.

• Admission to the Doctorate in Energy Studies is subject to the approval of the Head of Department.

• For further information and duration of studies, see General Information.

Website: geography@uj.ac.za
GEOLOGY

The Department of Geology at the University of Johannesburg is in the true sense of the word a cosmopolitan department with international reputation, status and standards. This fact is illustrated not only by the composition and international rating of the lecturers, but also by the diversity of the staff and students and active international cooperation at research level with institutions in the US, Canada, Europe, Russia, Brazil, Africa, India, Japan, China, Australia, UK, Argentina and Uruguay. Many of the postgraduate students are therefore also given the opportunity to visit some of these countries to undertake research. Students are consequently exposed to invaluable international contact and experience.

The academic staff have the largest per capita number of highly evaluated scientists (based on the evaluation system of the National Research Foundation) of any Geology Department in South Africa, and includes one A1-evaluated staff member. International contact and knowledge also form part of the philosophy behind the training of both undergraduate and postgraduate students, namely: To train professional geologists with a good understanding of Geology on a global scale so as to enable them to work or undertake research anywhere in the world.

A. Research projects are undertaken in collaboration with various institutions and universities worldwide. The national and international projects currently being pursued by the academic staff include:

- Interaction between styles of mineralisation and environmental change in the Precambrian:
- Geochronology, sedimentary provenance, sequence stratigraphy and palaeomagnetism of Mesoarchean to Palaeoproterozoic sedimentary successions on the Kaapvaal and Pilbara cratons.
- Multidisciplinary study of the Precambrian biosphere and surficial oxygenation, Kaapvaal Craton, South Africa.
- Investigations of iron deposits in South Africa, Brazil and India.
- Base metal deposits of the Bushmanland region, South Africa, Northern Cape and the Zambian Copperbelt.
- Tectonic setting and Cu-mineralisation in the Areachap Group, Province.

B. Provenance studies applied to understanding basin evolution and palaeogeographic reconstructions through time:

- Neoproterozoic relations between Southern Africa and South America.
- Provenance studies applied to the understanding of basin evolution through time.

C. Geology, sedimentology, evaluation and utilisation of southern African coal resources.

D. Documenting and publicising South Africa’s national geological, mineral and gemstone heritage.

E. Geodynamics of high-grade metamorphic terrains.

F. Geology of the Bushveld Complex and associated platinum group element mineralisation.
G. Mineralogical control on natural surface water quality in South Africa.

H. Medical geology
The UJ is situated in the heart of the mineral and mining industry in Southern Africa, which ensures good contact with the industry and facilitates career possibilities in all aspects of the mineral, mining, exploration and environmental industry. Employment opportunities are available worldwide, particularly in the rest of Africa.

Unique Courses
Because of the expertise available, the Department of Geology at the UJ offers a number of unique courses and research opportunities in South Africa. The most important of these is training and research in the geology and exploitation of ferrous mineral deposits, sedimentology of carbonate successions and associated Cu-Pb/Zn deposits, coal geology the geology and structure of high-grade metamorphic terranes, the geochemistry of igneous complexes and associated ore deposits, and provenance studies of Gondwana in South Africa and South America.

Bursaries and Research Funds
Due to the national and international standing of the academic staff and the excellent reputation of students who have completed their degrees successfully and found employment, extensive postgraduate bursaries and funds are available to the Department for research. Most of the postgraduate bursaries (Honours, Master’s and Doctorate) are linked to research funds of the University, the researchers or the Department and do not compel the students to work for a specific company or institution after completing their studies.

Analytical and Research Facilities
The Department houses a modern petrographic microscope facility, rock
preparation laboratory and separation facility for heavy minerals, particularly zircons used for age determinations of rock successions. The Department also runs the only infrared fluid inclusion petrographic microscope facility in the country. This facility is especially suitable for study of textures and fluid inclusions in opaque ore minerals like hematite and manganese oxides. Furthermore, the Department has a palaeomagnetic facility that is unique in Africa and a recently acquired Confocal Laser Raman Microscope. The Department also has access to the centralised analytical facility of the Faculty, also unique in South Africa. This facility houses the most modern apparatus available at any university in South Africa, including X-ray diffraction, X-ray fluorescence, electron microscopes, IC-PMS and other apparatus.

Chemical, stable isotope and radiogenic isotope analysis and age dating are normally contracted out to other laboratories in South Africa or overseas, such as palaeomagnetic facilities at Caltech in the USA and University of Western Australia in Perth, stable isotope analyses in Ottawa, Bochum and Münster, and radiogenic age determinations at MIT in Boston, Bern in Switzerland, UWA in Perth and the Australian National University in Canberra. The Department also has its own fleet of nine field vehicles for excursions and fieldwork.

HONOURS

Admission Requirements

On the basis of academic merit, with a minimum mark of 60% for geology, a maximum of 20 students per year are accepted into this course.

Selection Date

- Applications must be submitted by the end of October in the year prior to study.
- A selection committee that consists of the Department’s lecturing staff selects students early in November.

Course Content

- The Honours course consists of nine modules as listed below. All modules are compulsory.
- Most of the modules include weekend excursions and practical fieldwork.
• The Honours course is full-time and must be completed in one calendar year.

• The Modules are:
  • Sedimentary basin analysis and palaeontology
  • Tectonic evolution of mountain building areas
  • Geochemistry of igneous rocks
  • Chemical thermodynamics and metamorphic rocks
  • Geophysics and geology of Africa
  • Applied and environmental mineralogy
  • Economic geology and exploration management
  • Mining geology
  • Advanced field mapping
  • Expectations
  • Attendance of lectures in every module is compulsory.
  • Students must pass all nine modules to obtain the Honours degree.

Contact Time
Lecture periods vary from module to module but average two to four hours per day, excluding practicals and field work.

Duration
The Honours course is one calendar year or over two years part-time.

MASTER’S STUDIES
Admission requirements
• A BSc (Honours) degree (or equivalent)
• Applications for Master’s studies are submitted to the relevant staff member in the Department who specialises in the field of interest.
• All Master’s studies are directly linked to research.
• Approval for admission rests with the Supervisor, the Head and the Dean of the Faculty of Science.

Closing Date
According to Faculty requirements.

Content
The Master’s degree is based on a specified research topic as agreed upon with the students Supervisor.

DOCTORAL STUDIES
Admission Requirements
• Admission to a Doctorate is subject to the approval of the Head of Department. Approval for admission rests with the Supervisor, the Head and the Dean of the Faculty of Science.
• For further information and duration of studies, see General Information.
• For more information about the Department staff and their research programmes, consult:

Web site: www.uj.ac.za/science
MATHEMATICS

The specialist fields of the Department of Mathematics are Graph Theory, Functional Analysis, Algebra and Logic. The academic staff in the Department are actively involved in various research projects in these fields. Some of the research projects are undertaken in conjunction with colleagues at other universities in South Africa and abroad, e.g. the US, the Netherlands, Bulgaria, the Slovakian Republic, Poland and New Zealand.

Postgraduate studies in the Department develop the intellectual and analytical skills of the students and enable them to:

- Understand, evaluate, develop and apply mathematical theories in Mathematics and related fields.
- Understand and solve mathematical problems.
- Play a leadership role in the worlds of Mathematics – as researchers, lecturers and mathematical experts.

The career opportunities for persons with a postgraduate qualification in Mathematics depend on the level of training. The sectors that require mathematicians include financial institutions, the computer industry, the communication industry, teaching and other public sectors. The analytical thinking and problem-solving skills developed by a thorough study of Mathematics are important in any aspect of the professional world, which is why a mathematician is an asset to any organisation.

HONOURS

Admission Requirements

A Bachelor’s degree with Mathematics 3 as major and at least 60% in Mathematics at third-year level.

Students with exceptional mathematical skills may take some Honours modules in their third year.

Course Content

Nine subject modules and a module in the form of a project that includes both written and oral reports (in the form of a lecture presented in the Department of Mathematics). This project is worth 30 credits out of a total of 140 credits.

Modules

The subject modules are usually constituted as follows:

- Set Theory (1 module – first semester)
- Algebra (1 module – first semester)
- Topology (1 module – second semester)
- Ring Theory (1 module – second semester)
• Functional Analysis (2 Modules – both semesters)
• Graph Theory (2 modules – both semesters)
• Mathematical Logic (2 modules – both semesters).
• Measure and Integration Theory (1 module – second semester).
The Honours course may contain modules of other subjects, e.g. an Honours degree in Financial Mathematics may be composed of modules from Mathematics, Statistics, Applied Mathematics, etc.

Expectations
• Students must attend the lectures in every subject module. Both part-time and full-time students must attend lectures.
• Students must deliver one presentation per year (one presentation in two years in the case of part-time students) on their project.

Duration of Lectures
In every module of the Honours course, students must attend a lecture of about 90 minutes per week.

Examining
• Continual evaluation occurs on the basis of class participation and the writing of tests.
• One examination paper in all the modules, excluding the project, is written at the end of every semester.
• The subject modules are subject to external examining.

Composition of Marks
• The final mark in every subject module usually comprises a semester mark and an examination mark.
• The semester mark may comprise up to 40% of the final mark.
• Only a final mark is allocated to the project.

MASTER’S STUDIES
• Admission requirements
• An Honours degree in Mathematics.

RESEARCH-BASED MASTER’S STUDIES

Content of Degree Studies
• A dissertation comprising research on an approved topic.
• The dissertation is written under the guidance of a lecturer.

Expectations
• For the dissertation, students are not expected to develop new Mathematics. What is required is an original evaluation of existing mathematical theories, the highlighting of possible links and an original perception of the topic being studied.
• Students must deliver one presentation per year (one presentation in two years in the case of part-time students).

Examining
• In the case of a dissertation, no formal examination is written.
• The dissertation is subject to external examining.

DOCTORAL STUDIES

Admission Requirements
• A Master’s degree in Mathematics.
• Admission to a Doctorate is subject to the approval of the Head of Department.
• For further information and duration of studies, see General Information.
PHYSICS

The Department of Physics presents the fundamental concepts of Physics through programmes of theoretical courses to students and introduces them to the application of these concepts in practice. The Department sustains its modern and relevant teaching programmes by actively pursuing Physics research with the participation of postgraduate students. The Department has modern sophisticated research laboratories equipped with a large variety of processing and characterization equipment. Research degrees are offered in topics outlined below:

Astrophysics
The Department of Physics at the University of Johannesburg has seen a lot of vibrant research in astrophysics of late. In one project active galaxies are studied, specifically the class known as Seyfert galaxies. Another project focuses on pulsating stars, specifically the Beta Cephei-class of hot, young pulsating stars. Besides continuing observational programmes at Sutherland, this research is being expanded on two fronts: cutting-edge statistical methods, and theoretical modeling of stellar instabilities. In this project close collaboration exists with researchers at Wits and at the Hartebeesthoek Radio Astronomical Observatory. UJ is also nurturing joint projects with researchers at the University of Cape Town, Stellenbosch and Pretoria respectively. Researchers working on these projects are experienced users of the family of telescopes at the Sutherland station of the South African Astronomical Observatory (SAAO) in the Northern Cape. Innovative research has also been done on the use of astronomical observations to measure atmospheric pollution. The Stellar Astrophysics group uses the UJ computing cluster and the Open Science Grid.

Our astrophysics research programme involves work with the H-ATLAS consortium (www.hatlas.org), that is composed of over 150 astronomers worldwide and was awarded the largest observing time with the recently launched Hershel Space Observatory. We are also involved in various MeerKAT and South Africa Square Kilometer Array (SA SKA) related programmes.

Cr based research
Chromium and chromium alloys show interesting behaviour that has been investigated by scientists for decades – and yet they are still surprised every day by new findings. This group of metals is unique since the properties of chromium can be altered dramatically with the addition of even a small amount of impurities such as silicon, vanadium, etc. There is also renewed interest in acquiring knowledge of these alloys especially in the form of thin films, because of its applications in the field of data storage. In the Department there is an established group of Physicists further investigating the properties of bulk and thin film chromium alloys with the help of postgraduate students. Several collaboration agreements exist between this group, industries and universities in South Africa as well as overseas.

Correlations and ground states of matter
This research group performs experiments at extremely low temperatures (close to the absolute zero) and in very powerful magnetic fields (close to a million times the field strength of the earth) on metals
and intermetallic compounds to study magnetism, superconductivity, and other fundamental interactions in matter. We are the only laboratory in Africa with advanced instrumental stations to study a variety of physical properties (specific heat, magnetic properties, thermal and electronic transport) at these extreme conditions. A key area of our research involves physical chemistry and metallurgy to synthesize and discover exciting new compounds and alloys.

**Solar irradiation**

A team in the Department is quantifying the ground-level characteristics of solar radiation with the aim of determining its solar energy generation potential in the Gauteng urban environment, considering specific location altitude, land aspect, aerosol concentrations and weather patterns. This project aims to create an internet-based provincial solar atlas that will be available as a resource to the solar power industry and the public for solar panel installation. The work is part of the regional Enerkey initiative, which is exploring Gauteng’s energy consumption, management and future requirements.

**High Energy Physics**

The University of Johannesburg High Energy Physics group is a member of the SA-CERN Programme. They are working on the giant multi-purpose ATLAS detector, one of the experiments at the Large Hadron Collider (LHC) at CERN in Switzerland, as affiliates of Brookhaven National Laboratory. ATLAS will investigate a wide range of physics, including the search for the Higgs boson, extra dimensions, particles that could make up dark matter and the quark-gluon plasma. The UJ group works in close collaboration with Ketevi Assamagan, the co-leader of the ATLAS Higgs working group, and is therefore participating in the search for the Higgs. Future research may include the possible discovery of the charged Higgs and its relation to supersymmetry, which will develop new physics beyond our best current model of particles. The new high performance computing cluster at UJ, which also provides access to the Grid is a crucial component of the work. The Grid is the basis for access to data and the implementation of demanding computational physics simulations and analysis codes. The UJ Grid node has been developed in a collaboration with Jeremy Dodd and Mike Tutts of Columbia University and the Open Science Grid team, as well as Ben Clifford from the University of Chicago.

**Nuclear Physics**

UJ is launching a new Honours and Master’s course in the Science and Organisation of Nuclear Energy. The
course material has been developed in close collaboration with iThemba LABS, NECSA and the PBMR. Topics include the physics and mathematics behind nuclear reactions, statistical risk analysis, environmental impact and safety. The Master’s will involve a dissertation where research is carried out at UJ and in conjunction with scientists in the industry. The Nuclear Physics Group has an experimental program in light ion induced reactions at iThemba LABS together with collaborators from that laboratory as well as Milano University and Stellenbosch University. The group also pursues a program in high energy nuclear physics at Jefferson Labs in the USA. The quark structure of nucleons is studied by observing the production and decay of electro-produced baryonic resonances. A highlight in the Applied Nuclear Physics program has been the completion of the Technology Demonstrator diamond bearing rock sorter, in conjunction with Bateman. This machine is based on the combination of two nuclear-medical technologies: Gamma Radiation Therapy and the Diagnostic Imaging technique of Positron Emission Tomography. This technology is now being evaluated for the construction of the Mine Test Unit.

The group conducts research in Theoretical Nuclear Physics in both Nuclear Structure and Reactions. On the structure side, the structure of light exotic nuclei are studied, considering many-body descriptions of the novel features that exist towards the nucleon drip lines. That is related to the research in nuclear reactions, primarily nucleon-nucleus interactions and scattering, as that is one of the main ways that one gains knowledge of such structures. Related work in other reactions, as well as nuclear astrophysics (stellar evolution, nucleosynthesis - the creation of elements), also falls into this research sphere.

**Diamond Physics**

Diamond has extreme properties which suggest it in hitherto unimagined high technology roles, such as high performance radiation detectors, fast and high power electronic devices and as X-ray optical elements for high intensity synchrotrons. More recently, diamond is recognised as an ideal environment for storing coherent quantum states in an easily addressable manner, in the context of nanotechnology for quantum communication and computing. Several long standing collaborations exploit this potential. At iThemba LABS, the diamond group develops state of the art diamond scientific processing capacity. Diamond prepared here is used in experiments at ESRF-Grenoble on X-ray optical elements, in a collaboration with GSI-Darmstadt on radiation detectors, in a collaboration with Aarhus University on diamond’s radiation emission properties, in a collaboration with Rutherford LAB-Oxford on the role of hydrogen in diamond and in a collaboration with the University of Kwa-Zulu Natal on quantum diamond.
The Pressure is On
The focus is on studies of materials under extreme high pressure, routinely to 300 000 times the pressure of the atmosphere and up to higher pressures where necessary, over a wide range of temperature (-269°C to 2300 °C). These extreme conditions are attained in diamond-anvil high pressure cells, using lasers or electricity for high temperature work. Cutting edge equipment allows researchers to see how the system behaves with very small changes in pressure. Consequently quite unique and detailed investigations can be carried out. Research is in, but not limited to, the following areas:

• Magnetic-electronic pressure studies of hot topic strongly correlated electron systems.
• Studies of iron-based mineral assemblages under (high pressure-temperature) deep Earth conditions.
• Pressure-response of nano-phase materials and search for new ultra-hard materials (as alternatives to diamond).

Electronic structure of correlated materials
We study complex materials where the interactions between electrons play an important or decisive role in the determining the, often unusual, properties of the system. Many of the most interesting materials studied today have such electron correlations at their heart. This results in properties such as high temperature superconductivity, giant magnetoresistance and orbital and charge orderings. Experimental measurements are carried out both within the Department using sophisticated low-temperature equipment available and at overseas synchrotron radiation laboratories in Paris and Berlin.

HONOURS
Admission Requirements
• Admission to the BSc-Honours (Physics) course requires the permission of the Head of Department.
• 60% for Physics on third-year level is a prerequisite.

Closing Date
• End of November.
• Ad hoc applications will be considered under special circumstances until mid-February.

Course Content
The theoretical part of the course consists of eight semester modules, spread over two semesters:

First Semester
1. Quantum Physics A
2. Statistical Physics A
3. Solid State Physics A OR Nuclear Physics
4. Mathematical Methods

Second Semester
1. Quantum Physics B
2. Statistical Physics B OR Advanced Nuclear and Particle Physics
3. Solid State Electronics
4. Electromagnetism

• Students may enrol for a maximum of four semester courses in UJ departments other than Physics, with the approval of the Head of Department, in lieu of the courses under groups 3 and 4 from the above list.
• Experimental work comprises two further semester modules, which consist of advanced experiments related to the current research activities in the Department.
Expectations

- Each course must be passed individually.
- The attendance of all lectures is compulsory.

Contact Time

- Lectures are presented according to the academic timetable. One weekly lecture of 90 minutes is presented for each semester course.
- The experimental work runs concurrently with the theoretical course work for the duration of the academic year.
- Part-time students may be allowed to have their courses spread over two years.
- Student assistantships are available for students to work in the Department during their BSc-Honours study year.

Duration

One year of full-time study.

MZONE COURSE

The Department also offers a MZONE course. This Masters in the Science and Organization of Nuclear Energy consist of two years of study: one year lectured courses on Honours level and one year research work on Masters level. The entrance requirement is a BSc-degree.

MASTER’S STUDIES

Admission Requirements

- A BSc-Honours degree or an equivalent qualification with a major in Physics is a prerequisite.
- Approval for admission to a particular study field requires consultation with and approval of the relevant research degree supervisor.
- Students may undertake their MSc-degrees either full-time or part-time at the discretion of the degree supervisor.

Closing Date

- Applications for Master’s degree enrolment should preferably be submitted at the beginning of the academic year, but applications are also considered throughout the calendar year.
- Registration is done according to the academic calendar.

Content of Degree Studies

- For an MSc-degree, students need to complete a research assignment or research project in one of the research fields outlined above.
- Students need to show satisfactory progress in their experimental work for the duration of their MSc degree programme.
- The degree is conferred on successful completion of a written dissertation based on the subject and outcomes of the research.

Expectations

- Students are required to present research results at national and international conferences, as well as to participate in departmental seminars.
- At least one peer-reviewed research publication should follow from the results of the research performed for an MSc degree.

DOCTORAL STUDIES

Admission Requirements

- A Master’s in Physics or an equivalent qualification, subject to the approval of the Head of Department
- Admission to a Doctorate is subject to the approval of the Head of Department.

For further information and duration of studies, see General Information.
Statistics

Statistics is a discipline which is mainly concerned with designing experiments and other data collection methods, summarizing information to aid understanding, drawing conclusions from data and estimating the present or predicting the future. Examples of problems where Statistics plays an important role can be found in almost all spheres of science. Some examples include the study of the occurrence and spread of diseases where the effective treatment of diseases cannot be determined without contributions from a statistician, the development of new farming methods relies heavily on statistical techniques and in the designing and testing of new machinery engineers make extensive use of statistical principles. Also, in the collection of information concerning the quality of life of a country’s population, the planning, implementation and processing of nationwide surveys rest largely on statisticians in order to obtain Statistics that are reliable and representative of the population under investigation.

In the financial sector, long term and short term insurance companies as well as the banking industry are extremely dependent on statisticians to provide them with important Statistics by implementing appropriate risk modelling techniques to measure various types of risk such companies may face. Without these Statistics, it would be virtually impossible for these companies to make informative decisions in order to avoid certain risks that may badly influence the financial health of their business. Due to the current severe shortage of properly trained statisticians in South-Africa, there is a huge demand for their services, both in the private sector and academic environment.

Pupils and students with a strong mathematical ability and interest, often find that the science of Statistics can lead to a challenging career, providing job satisfaction and excellent opportunities. Recruitment to the profession of statistician is usually at graduate level, so for most people the first step towards the profession is to get a degree in Statistics or in a joint subject such as Mathematics and Statistics which has a high statistical content. Admission to these degree courses nearly always requires a good performance in A level Mathematics. There are also many other joint degrees involving Statistics, such as Economics and Statistics, or Statistics...
and Business Studies, which may well be good stepping stones to a career in Statistics and which, in some cases, have less demanding mathematical requirements for entry. Therefore one advantage of working with Statistics is that you can combine your interest with almost any other field in science, technology, or business, such as Agriculture, Insurance, Biology, Law, Chemistry, Manufacturing, Computer Science, Marketing, Economics, Public Health, Education, Sports, Engineering, Telecommunications, Epidemiology, Finance and Health Sciences.

Current fields of research in the Department include Credit Risk Modelling, Long Memory Time Series Analysis and Biostatistics.

HONOURS

Admission Requirements
A Bachelor’s degree with:

• First and second year level Mathematics with a minimum average of 65% at second year level.
• First, second and third year level Mathematical Statistics with a minimum average of 65% at third year level.

Closing Date: End of October.

Course Content

• Ten modules must be passed. In most cases, two consecutive modules form a unit in that the first is a prerequisite for the second.
• The modules that are available in any particular year are determined by the demand from students.
• A maximum of four modules may be taken from Mathematics, Applied Mathematics or Computer Science, subject to the approval of the Head of Department.
• There is a weekly meeting of about eighty minutes in each module.
• Lecture times are scheduled in a meeting with all the Honours students at the beginning of the academic year. These times are chosen in a manner that accommodates the needs of part-time students.

The modules to be selected include:

• Project – compulsory –year module with an equivalent weight of two semester modules
• Stochastic Processes 1
• Time Series Analysis 1 and 2
• Stochastic Calculus 1
• Derivative Instruments 1 and 2
• Experimental Design
• Probability Theory 1
• Non-parametric Statistics 1

Expectations

• Students must provide assistance to first-year students during weekly tutorials for a minimum of 4 hours per week.
• Students must attend departmental seminars.
• Full-time students may apply for an assistantship.
• Students appointed as assistants must complete between six and ten hours of academic and administrative duties per week in the Department as prescribed by the Head of Department.

Contact Time

Students work at their own pace and according to their own planning. Full-time students are expected to complete the degree in one year and part-time students in two years.
**MASTER’S STUDIES**

**Admission Requirements**
An Honours degree in Mathematical Statistics with an average of at least 70%. Admission to a Master’s degree in Mathematical Statistics is subject to the availability of a suitable supervisor for the research topic of interest.

**Closing Date**
End of October.

**RESEARCH-BASED MASTER’S STUDIES**

**Content of Degree Studies**
A dissertation that comprises of research on an approved topic.

**Closing Date**
End of October.

**Expectations**
Students work in conjunction with their supervisor. Full-time students are expected to complete the degree within 12 to 24 months and part-time students between 12 and 36 months.

**DOCTORAL STUDIES**

**Admission Requirements**
- A Master’s degree in Mathematical Statistics or equivalent field of study with an average of at least 70%.
- Admission to a Doctorate is subject to the approval of the Head of Department and the availability of a suitable supervisor for the research topic of interest.
- The minimum duration for a full-time student is 1 year and the maximum duration is 3 years
- The minimum duration for a part-time student is 1 year and the maximum duration is 5 years

For further information and duration of studies, see General Information.

**ZOOGY**

The courses in the Department of Zoology have specifically been compiled to train environmental scientists intensively and according to the requirements specified in the Environmental and Water Legislation. The Department is particularly concerned with water research and has been involved in such research for the past 37 years. The recognition that the Department enjoys in this field is reflected by a long list of institutions for which contract work is undertaken. A consultation service to the industry is also rendered by a Consortium of Environmental Specialists.

There is close collaboration with the Universities of Limpopo, Free State, Zululand, Stellenbosch and Pretoria as well as universities in Germany, Israel, Denmark, Finland, Australia, the USA and UK. Regular contact with institutions such as the CSIR, National Research Foundation, Agricultural Research Council, Water Research Commission and Government Departments (Conservation and Environmental Affairs) is the order of the day.

With the new programme-oriented training, training and research is provided in the specialist fields.
Intensive research is undertaken in various fields, namely:
• Physiological effects (biomarkers)
• Fish health index (including parasitology)
• Effects on reproductive physiology
• Histopathological
• Biological control of water plants
• Aquatic integrity
• Biomonitoring
• Population Genetics
• Molecular taxonomy
• Biosistematics/ Biodiversity
• Parasite ecology
• Ground Water Ecology

Job opportunities are available in many environments. Researchers, nature conservation scientists, agricultural researchers, conservation officer, pollution control officers, environmental consultants, teachers, lecturers and managers of laboratories are the most important positions. Further qualifications can be obtained. The training concentrates on theoretical knowledge that can be applied in the workplace.

**HONOURS**

**Admission Requirements**
• A Bachelor’s degree with Zoology as a major.
• Application forms and a prospectus are available from the Departmental Secretary.
• The Department will notify successful candidates.

**Closing Date**
• End of October
• Each programme consists of 12 modules selected from the following:

There are three programme groups, namely:
• Laboratory and Field Skills
• Philosophy and Research Methodology in Zoology
• Population Genetics and Biosystematics
• Ecophysiology
• Nature Conservation
• Fish Histology and Histopathology
• Research Project
• Mammal Diversity
• Indices for Biotic Integrity of Aquatic Ecosystems
• Aquatic Reserve Management and Remediation
• Aquatic Parasitology
• Terrestrial and Conservation Ecology

The Department annually determines the combination of modules for the different programmes.

**Expectations**
• Students must be available full-time according to the timetable.
• Students must undertake a compulsory excursion.

**Working Hours**
• Assistantships – for which students can apply – are available.
• Specific working hours are linked to assistantships.
Contact Time
• Lectures according to the academic timetable.
• Excursions according to a specific programme.

Duration
One year full-time

MASTER’S STUDIES
Admission Requirements
• An Honours degree in Zoology.
• Approval of the course leader.
• Recognition of prior learning in related disciplines.
• Relevant BSc-Honours degree in Biological Sciences with Zoology as a major or Environmental Sciences (coursework Master’s)

Closing Date
End of October

Expectations
• Full-time students may apply for an assistantship. Assistants work for a minimum of four hours per week in the Department as tutors, general assistants and demonstrators.
• Assistance to Honours students in the laboratory with experiments that form part of the compulsory projects.
• Students provide assistance to first-year students during weekly tutorials.
• Students must attend departmental seminars and colloquia.
• Assisting other postgraduates during field excursions.

COURSEWORK MASTER’S STUDIES
• Three question papers.
• A minor-dissertation on a topic in the Department.

RESEARCH-BASED DISSERTATION
• A dissertation on an approved topic.
• An article for publication.
• Two seminar presentations.

RESEARCH FIELDS
• Population Genetics
• Aquatic Parasitology
• Ecophysiology
• Histopathology
• Reproductive Physiology
• Invertebrate Ecology
• Cave Ecology
• Ecotoxicology
• Conservation Ecology
• Bio-systematics
• Palaeontology
• Parasitology
• Respiration Physiology
• Molecular Evolution
• Vector Biology

Contact Time
• As determined by the course leader.
• Master’s and Doctoral studies may be completed either part-time or full-time.

Articles
Articles must be published as agreed with the supervisors.

DOCTORAL STUDIES
Admission Requirements
• MSc in Zoology or relevant MSc for PhD in Aquatic Health
• Admission to a Doctorate is subject to the approval of the Head of Department.
• For further information and duration of studies, see General Information.

For more information, consult:
www.uj.ac.za/science