**FACULTIES OF THE
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HUMANITIES
NATURAL AND AGRICULTURAL SCIENCES
LAW
THEOLOGY
ECONOMIC AND MANAGEMENT SCIENCES
VETERINARY SCIENCE
EDUCATION
HEALTH SCIENCES
ENGINEERING, BUILT ENVIRONMENT AND INFORMATION TECHNOLOGY

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Programmes in the different fields of specialisation:

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Ashton, P.J., BSc(Hons) MSc PhD(Rhodes) ..... Extraordinary Professor
Grabow, W.O.K., BSc(Hons) MSc DSc(Pretoria) ..... Extraordinary Professor
Paweska, J.T., BVSc DVSc Dr hab ..... Extraordinary Professor
Rupprecht, C.E., BA(Rutgers Univ) MSc(Wisconsin) VMD(Pennsylvania) PhD(Wisconsin) ..... Extraordinary Professor
Pietersen, G., MSc(Pretoria) PhD(Witwatersrand) ..... Extraordinary Professor
Coutinho, T.A., BSc(Hons) MSc PhD(Natal) ..... Professor
Nel, L.H., MSc(Free State) PhD(Pretoria) ..... Professor
Korsten, L., BSc(Hons)(Stellenbosch) MSc PhD(Pretoria) ..... Professor
Roux, J., MSc PhD(Free State) ..... Professor
Aveling, T.A.S., MSc PhD(Natal) ..... Associate Professor
Labuschagne, N., MSc(Agric) DSc(Agric)(Pretoria) PrSciNat ..... Associate Professor
Steenkamp, E.T., BSc(Hons) MSc (Free State) PhD(Pretoria) ..... Associate Professor
Theron, J., BSc BSc(Hons) MSc PhD(Pretoria) ..... Associate Professor
Markotter, W., BSc(Hons) MSc PhD(Pretoria) ..... Senior Lecturer
Moleleki, L.N., BSc(Hons) MSc(KwaZulu-Natal) PhD(Univ of Dundee, UK) ..... Senior Lecturer
Thantsha, M., BSc(Hons)(Univ of the North) MSc PhD(Pretoria) ..... Senior Lecturer
Van der Waals, J.E., MSc(Agric) PhD(Pretoria) ..... Senior Lecturer

Department of Physics

Adam, R.M., BSc(Hons)(Chem)(Cape Town) BSc(Hons)(Phys) MSc PhD(Unisa) ..... Honorary Professor
Bharuth-Ram, K., BSc(Hons) MSc(Natal) DPhil(Oxon) ..... Honorary Professor
Chakraborty, P., MSc PhD(Calcutta, India) ..... Honorary Professor
Gries, W., BSc MSc(Pretoria) PhD(Stellenbosch) ..... Honorary Professor
Malaza, E.D., MSc(Brown) DPhil(Cantab) ..... Honorary Professor
Van der Merwe, J.H., MSc(Appl Maths)(Stellenbosch) MSc(Maths)(Pretoria) PhD(Bristol) ..... Honorary Professor
Vilakazi, Z.Z., MSc PhD(Witwatersrand) ..... Honorary Professor

Boeyens, J.C.A, MSc(Free State) DSc(Pretoria) FRSSA .....Extraordinary Professor
Friedland, E.K.H., MSc DSc(Pretoria) .....Extraordinary Professor
Alberts, H.W., BSc(Hons) MSc(Potchefstroom) DSc(Pretoria) .....Emeritus Professor
Bredell, L.J., MSc DSc(Pretoria) .....Emeritus Professor
Gaigher, H.L., MSc DSc(Pretoria) .....Emeritus Professor
Kunert, H.W., MSc(Poznan) PhD(Warszawa) .....Emeritus Professor
Malherbe, J.B., MSc DSc(Pretoria) .....Emeritus Professor
Van Staden, J.C., MSc(Pretoria) Dr Rer Nat(Heidelberg) .....Emeritus Professor
Van der Berg, N.G., BSc(Port Elizabeth) MSc(Unisa) .....Emeritus Senior
DSc(Pretoria).....Lecturer
Auret, F.D., MSc(Physics) MSc(Appl Maths) DSc(Pretoria) .....Professor
Rakitianski, S., MSc(Tashkent) PhD(Joint Institute for Nuclear
Research, Dubna, Russia).....Professor
Selyshchev, P., PhD(Inst. For Nuclear Research,
Taras Shevchenko Kyiv University).....Professor
Theron, C.C., BSc(Hons)(PortElizabeth)
MSc PhD(Stellenbosch).....Professor
Chetty, N., BSc(Hons)(Natal) MS PhD(Illinois) .....Associate Professor
Diale, M., BSc(Ed)(UNIBO) MSc(Medunsa) PhD(Pretoria).....Senior Lecturer
Duvenhage, R. deV., BSc(Hons) MSc PhD(Pretoria) .....Senior Lecturer
Manyala, N.I., BSc(Hons) MSc(Witwatersrand)
PhD(Louisiana State Univ).....Senior Lecturer
Meyer, W.E., MSc PhD(Pretoria) .....Senior Lecturer
Moji, C., BSc(Hons)(University of the North) MSc PhD(Natal) .....Senior Lecturer
Nel, J.M., BSc(Hons)(Port Elizabeth) MSc(Cape Town)
PhD(Pretoria) .....Senior Lecturer
Hlatshwayo, T.T MSc(Zululand) PhD(Pretoria)..... …Lecturer
Janse van Rensburg, P.J., BSc(Hons)(Pretoria) .....Lecturer
Legodi, M.J., BSc(Medunsa) MSc(Pretoria) .....Lecturer
Machatine, A., MSc(Leipzig) .....Lecturer
Odendaal, R.Q., MSc(Pretoria) .....Lecturer
Prinsloo, L.C., MSc HED PhD(Pretoria) .....First Technical
Assistant

Department of Physiology

Van Papendorp, D.H., MBChB(Pretoria) BSc(Hons) .....Professor (Head)
MSc PhD(Stellenbosch) M.Akad.SA
Joubert, A.M., MSc PhD(Pretoria) .....Professor
Pretorius E., BSc(Hons) MSc(Stellenbosch) PhD DTI(Pretoria) .....Professor
Apatu, R.S.K., MBChB(Ghana) PhD(Cantab).....Associate Professor
Ker, J., MBChB MMed(Int) PhD(Pretoria) MRCP(Edinburgh).....Associate Professor
Fellow: European Society of Cardiology
Viljoen, M., MSc PhD(Pretoria) PhD(Witwatersrand).....Emeritus Professor
Nat Dip(Microbiology)
Dippenaar, N.G., MSc(Stellenbosch) MPhil(Cantab) .....Extraordinary
PhD(Medunsa) DipMedTech(ChemPath).....Professor
Coetzee, M., BSc(DomSci)(Ed) MSc(Potchefstroom)
PhD(Pretoria) .....Senior Lecturer
Du Toit, P.J., BSc MSc PhD(Pretoria) .....Senior Lecturer
Soma, P., MBChB(Medunsa) MSc(Pretoria) .....Senior Lecturer
Abraham, S., MBChB(Transkei).....Lecturer
Alummoottill, S., BSc MSc(India) .....Lecturer

Govender, C.O., BSocSci(Hons) MA Clinical Psychology MSc(Pretoria) ..... Lecturer
Grobbelaar, C.W., MBChB(KwaZulu-Natal) MSc(Pretoria) ..... Lecturer
Koorts, A.M., MSc PhD(Pretoria ..... Lecturer
Theron, A.E., MBChB BSc(Hons)(Pretoria) ..... Lecturer

Department of Plant Production and Soil Science

Annandale, J.G., MSc(Agric)(Pretoria) PhD(WSU) ..... Professor (Acting Head)
Bristow, K.L., BSc(Hons)(Natal) MSc(Free State) PhD(WSU) ..... Honorary Professor
Duke, S.O., MS(Univ Arkansas) PhD(Duke Univ) ..... Extraordinary Professor
Everson, C.S., BSc(Hons) MSc PhD (KwaZulu-Natal) ..... Extraordinary Professor
Haverkort, A.J., MSc(Wageningen) PhD(Reading) ..... Extraordinary Professor
Reinhardt, C.F., BSc(Hons)(Free State) BSc(Agric)(Hons) MSc(Agric) PhD(Pretoria) ..... Extraordinary Professor
Singels, A., BSc(Agric)(Hons) MSc(Agric) PhD(Free State) ..... Extraordinary Professor
Stirzaker, R.J., MSc(Agric) PhD(Sydney) ..... Extraordinary Professor
Chirwa, P. W. C., BSc(Hons)(Bangor) MSc(Gainesville, Florida) PhD(Nottingham) ..... Associate Professor
Du Toit, E.S., BSc(Hons) MSc(Agric) PhD(Pretoria) ..... Associate Professor
Soundy, P., MSc(Agric)(Natal) PhD(Florida) ..... Associate Professor
Steyn, J.M., BSc(Hons) MSc(Agric)(Free State) PhD(Pretoria) ..... Associate Professor
Avenant, E., BSc(Hons) MSc(Agric)(Pretoria) ..... Extraordinary Lecturer
Ghebremariam, T.T., MSc(Agric)(Pretoria) ..... Extraordinary Lecturer
Karsen, P.A., MSc(Agric)(Stellenbosch) ..... Extraordinary Lecturer
Van der Laan, M., BSc(Hons) MSc(Agric) PhD(Pretoria) ..... Extraordinary Lecturer
Surridge-Talbot, A.K.J., BSc(Hons) MSc PhD(Pretoria) ..... Extraordinary Lecturer
Vahrmeijer, J.T., BSc(Hons) MSc(Potchefstroom) ..... Extraordinary Lecturer
Madakadze, I.C., BSc(Agric)(Hons)(Zimbabwe) MSc(Reading) PhD(McGill) ..... Senior Lecturer
Taylor, N. J., PhD(KwaZulu-Natal) ..... Senior Lecturer
Truter, W. F., MSc(Agric) PhD(Pretoria) ..... Senior Lecturer
De Jager, P.C., BSc(Hons)(Potchefstroom) MSc(Pretoria) ..... Lecturer
Marais, D., BSc(Agric)(Hons) MSc(Agric) PhD(Pretoria) ..... Lecturer
Moshia, M.E., BSc(Agric)(Univ of the North) PhD(Colorado State) ..... Lecturer
Tesfamariam, E.H., MSc(Agric) PhD(Pretoria) ..... Lecturer
Vorster, B.J., MSc PhD(Pretoria) ..... Lecturer

Department of Plant Science

Meyer, J.J.M., PhD(Pretoria) ..... Professor (Head)
Bredenkamp, G.J., DSc(Pretoria) THOD FLS PrSciNat MSAIE ES MGSSA ..... Extraordinary Professor
Smith, G.F., PhD (J.P.H.Acocks Chair) ..... Extraordinary Professor
Berger, D.K., PhD(Cape Town) ..... Professor
Van Wyk, A.E., MSc(Potchefstroom) DSc(Pretoria) HED FLS ..... Professor
Lall, N., PhD(Pretoria) ..... Associate Professor
Rouget, M.J.F., PhD(Cape Town) ..... Associate Professor
Van Rooyen, M. W., PhD(Pretoria) HNED ..... Associate Professor
Kunert, K.S., PhD (Konstanz Germany) ..... Senior Research Fellow
Chikwamba, R.K., PhD(USA) ..... Extraordinary Senior Lecturer

Crampton, B.G., PhD(Pretoria).....Senior Lecturer
Kritzinger, Q., PhD(Pretoria) .....Senior Lecturer
Tshikalange, T.E., MSc PhD(Pretoria) .....Senior Lecturer
Bapela, M.J., MSc(Pretoria) .....Lecturer
Kiviet, A.M., BSc(Hons)(Fort Hare) MSc(Michigan State Univ)
HED(Transkei) BEd DEd(Unisa) MEd(Columbia, USA).....Lecturer

Postgraduate School of Agriculture and Rural Development
Machethe, C.L., BSc(Agric)(Hons)(Fort Hare)
MSc(Agric)(University of the North) M.S. PhD(Michigan) .....Professor / Director

SADC Centre for Land-related, Regional and Development Law and Policy
Olivier, N.J.J., BA(Law) LLB BA(Hons)(Pretoria)
Drs Juris LLD(Leiden) MA(Pretoria)
BA(Hons)(Potchefstroom) LLD(Pretoria).....Professor / Director

SAFCOL Forest Science Chair
Chirwa, P. W. C., BSc(Hons)(Bangor) MSc(Gainesville, Florida) .....Director /
PhD(Nottingham).....Associate Professor

Department of Statistics
Crowther, N.A.S., BSc(Hons)(Free State) MSc(Port Elizabeth)
DSc(Free State)..... Professor (Head)
Stoker, D.J., BSc MSc(Potchefstroom) MSc(Stellenbosch)
Dr(Math&Phys)(Amsterdam)..... Honorary Professor
Smit, C.F., MSc DSc(Pretoria) ..... Emeritus Professor
Van Zyl, G.J.J., BCom(Stellenbosch) PhD(North Carolina) ..... Professor, Acting Director STATOMET
Chakroborti, S., PhD(State University of New York)..... Professor (SARchi chair holder)
Bekker, A., MSc(Johannesburg) PhD(Unisa) ..... Associate Professor
Crafford, G., MSc PhD(Pretoria) ..... Senior Lecturer
Debusho, L.K., MSc(Addis Ababa) PhD(KwaZulu-Natal)..... Senior Lecturer
Fletcher, L., MSc PhD(Unisa)..... Senior Lecturer
Kanfer, F.H.J., MSc PhD(Potchefstroom)..... Senior Lecturer
Louw, E.M., MSc PhD(Pretoria) ..... Senior Lecturer
Millard, S.M., MCom(Pretoria)..... Senior Lecturer
Swanepoel, A., MSc(Port Elizabeth) ..... Senior Lecturer
Adamski, K., BSc(Hons) MSc(Pretoria)..... Lecturer
Basson, E.M., BSc(Hons) MSc(Pretoria)..... Lecturer
Bodenstein, L.E., BCom(Hons) MCom(Pretoria) ..... Lecturer
Coetsee, J., BCom(Hons) MCom(Pretoria) ..... Lecturer
Corbett, A.D., BCom BSc(Hons)(Pretoria)..... Lecturer
De Villiers, G.M., BSc(Hons) MSc(Pretoria) ..... Lecturer
Ehlers, R., MSc PhD(Pretoria) ..... Lecturer
Fabris-Rotelli, I.N., BSc(Hons) MSc(Pretoria)..... Lecturer
Graham, M.A., BSc(Hons) MSc(Pretoria)..... Lecturer
Reyneke, F., BSc(Hons) MSc(Pretoria)..... Lecturer
Strydom, H.F., BSc(Hons)(Pretoria) MSc(Unisa) HED(Pretoria)..... Lecturer
Van Staden, P.J., BCom(Hons) MCom(Pretoria)..... Lecturer

Wingfield M Mondi Chair
Roux, J., PhD(Free State)....Professor

Department of Zoology and Entomology
Nicolson, S.W., BSc(Hons)(Auckland) PhD(Cantab) FRES....Professor (Head)
Best, P.B., MA PhD(Cantab)....Extraordinary Professor
Clutton-Brock, T.H., MA PhD ScD(Cantab)....Extraordinary Professor
Crewe, R.M., BSc(Agric) MSc(Agric)(Natal) PhD(Georgia) FRES FRSSA MSAAS PrSciNat....Extraordinary Professor
Dippenaar-Schoeman, A.S., BSc(Unisa) BSc(Hons) MSc PhD(RAU)....Extraordinary Professor
Du Toit, J.T., BSc(Hons) PhD(Witwatersrand)....Extraordinary Professor
Faulkes, C.G, PhD (University College London)....Extraordinary Professor
Getz, W.M., BSc BSc(Hons) PhD(Witwatersrand)....Extraordinary Professor
Kfir, R., BSc(Agric) MSc(Agric) PhD(Hebrew University Jerusalem)....Extraordinary Professor
Mansell, M.W., BSc(Hons) PhD(Rhodes)....Extraordinary Professor
Moritz, R.F.A., Dip PhD(Frankfurt)....Extraordinary Professor
Bennett, N.C., BSc(Hons)(Bristol) MSc PhD(Cape Town) FZS....Professor
Bester, M.N., BSc(Hons) MSc(Stellenbosch) DSc(Pretoria) PrSciNat....Professor
Chimimba, C.T., BSc(Malawi) MSc(Western Australia) PhD(Pretoria) FLS FZS(London) PrSciNat....Professor
Ferguson, J.W.H., BSc(Port Elizabeth) BSc(Hons) MSc(Pretoria) PhD(Witwatersrand)....Professor
Millar, R.P., MSc(London) PhD(Liverpool) RFCPath FRSE FRSSA....Professor (Director)
Scholtz, C.H., BSc(Hons) MSc DSc(Pretoria) FRES....Professor
Van Aarde, R.J., MSc DSc(Pretoria) PrSciNat....Professor
Bastos, A., BSc(Hons) MSc PhD(Pretoria)....Associate Professor
Janse van Rensburg, B., BSc(Hons)(Free State) MSc PhD(Pretoria)....Associate Professor
McKechnie, A.E., MSc PhD(Natal)....Associate Professor
Garnas, J.R., BA(Colorado) MSc(Maine) PhD(Dartmouth)....Senior Lecturer
Krüger, K., MPhil(Wales) PhD(Pretoria) FRES....Senior Lecturer
Pirk, C.W.W., MSc(Berlin TU) PhD(Rhodes)....Senior Lecturer
Robertson, M.P., BSc BSc(Hons) PhD(Rhodes)....Senior Lecturer
De Bruyn, P.J.N., BSc(Hons) MSc PhD(Pretoria)....Lecturer
Hurley, B., BSc(Hons) MSc PhD(Pretoria)....Lecturer
Golpalraj, J.B.P., BSc MSc(Madurai Kamaraj Univ)....Lecturer

BSc Four-year Programme
Kritzinger, Q., PhD(Pretoria)....Senior Lecturer /Director
Carney, T.R., BA(Hons)(Pretoria) MA(Pretoria)....Lecturer
Fouché, I., BA(Hons)(Pretoria) MA(Pretoria)....Lecturer
Tloti, S., BA(Hons)(Fort Hare)....Lecturer
Immelman, S., BA(Hons)(Unisa)....Junior Lecturer

Student Administration
Beresford, M.E., Mrs .....Head: Student Administration

Faculty Manager
Kotze, S.l, MA PhD(Pretoria)

POSTGRADUATE REGULATIONS

The rules for postgraduate qualifications published here are subject to change and may be amended prior to the commencement of the academic year in 2012.

Also refer to General Regulations of the University of Pretoria.

Postgraduate qualifications in the Faculty of Natural and Agricultural Sciences

The following postgraduate qualifications are conferred by the Faculty:

Bachelor of Science Honours	[BScHons]
Bachelor of Agricultural Science Honours	[BScAgricHons]
Bachelor of Agricultural Management Honours*	[BInstAgrarHons]
Master of Consumer Science	[MConsumer Science]
Master of Science	[MSc]
Master of Agricultural Science	[MScAgric]
Master of Philosophy	[MPhil (Wildlife Management)]
Master of Agricultural Management*	[MInstAgrar]
Doctor of Philosophy	[PhD]
Doctor of Science	[DSc]

**(Coordinated in the Postgraduate School of Agriculture and Rural Development. Please consult page 89 for information and Regulations).*

Selection
A selection procedure takes place prior to admission to the following degree programmes in the Faculty of Natural and Agricultural Sciences:

BScHons in Chemistry: Applications close on 15 December.
BScHons in Mathematical Statistics: Admissions test compulsory for admission.
BScHons in Wildlife Management: Applications close on 30 October.
MScAgric in Animal Science (all specialisations): Applications close on 30 October.

DISCLAIMER
The Faculty reserves the right not to offer a particular module or programme if there is insufficient resources to do so, or if an insufficient number of qualifying students present themselves.

Bachelor of Science Honours [BScHons]

(Refer to General Regulations G.16 - G.29)

a. Admission to study
In addition to the requirements of General Regulations G.1.3 and G.62, an appropriate bachelor's degree is a prerequisite: a candidate with an average of less than 60% in the major subjects in the final year of the bachelor's degree will only be

admitted with the approval of the Dean, on the recommendation of the head of department. Additional conditions may be prescribed by the head of department.

b. Duration of study
The duration of study is a minimum of one year for full-time candidates, and two years for part-time candidates.

c. In calculating marks, General Regulation G.12.2 applies.

d. The BScHons degree is awarded with distinction to a candidate who obtains a weighted average of at least 75% in all the prescribed modules and a minimum of 65% in any one module.

e. Apart from the prescribed coursework, a research project is an integral part of the study.

f. The BScHons degree is conferred in the following fields of study:

- Actuarial Science
- Animal Science
- Biochemistry
- Bioinformatics
- Biotechnology
- Plant Science
- Chemistry
- Entomology
- Environmental Sciences
- Engineering Geology and Hydro-geology:
  Option: Engineering Geology
  Option: Hydrogeology
- Physics
- Food Science
- Genetics
- Geography
- Geoinformatics
- Geology
- Mathematical Sciences
- Meteorology
- Microbiology
- Nutrition and Food Science
- Soil Science [Option: Environmental Soil Science]
- Wildlife Management
- Zoology
- Human Physiology *(Please refer to the Postgraduate publication of the Faculty of Health Sciences)*

Bachelor of Agricultural Science Honours [BScAgricHons]

a. Admission to study
In addition to the requirements of General Regulations G.1.3 and G.62, the BScAgric degree is a prerequisite: a candidate with an average of less than 60% in his or her major in the final year of the bachelor's degree will only be admitted with the approval of the Dean, on the recommendation of the head of the department. Additional conditions may be prescribed by the head of department.

b. Fields of study
Plant Production (Agronomy/Horticulture/Pasture Science/Soil Science)
No intake for 2012.

c. Duration of study

All honours students are expected to study full-time for at least two semesters at the University (see General Regulations G.18 and G.22).

d. Curriculum

The BScAgricHons programme extends over at least two semesters and comprises the following:

i) Advanced lectures, literature studies and seminar presentations on the major subject/s and related disciplines. Where applicable, a research project of limited scope as well as specific tasks and/or practical work form part of the curriculum.

ii) Other ancillary modules, as approved by the Dean on the recommendation of the head of department. Such ancillary modules may be taken simultaneously with the major subject/s.

Details relating to the different fields of study are given separately.

e. Examination and promotion

The examinations in the ancillary modules should be successfully completed prior to, or simultaneously with, the examinations in the major subject/s, unless the Faculty Board decides otherwise.
General Regulation G.12 applies to the calculation of marks.

f. Degree with distinction

The BScAgricHons degree is awarded with distinction to a candidate who obtains a weighted average of at least 75% in all the prescribed modules and a minimum of 65% in any one module.

Bachelor of Agricultural Management Honours [BInstAgrarHons]

Please refer to the Regulations of the Postgraduate School of Agriculture and Rural Development, page 89.

Master of Science [MSc]

(Refer to General Regulations G.30 to G.62)

a. Admission to study

i) In addition to the General Regulations G.1.3, G.30 and G.62, an appropriate BScHons degree is a prerequisite for admission. An average of 60% is required in the honours year of study for admission to the MSc. Additional requirements and conditions may be prescribed by the Dean on the recommendation of the supervisor, head of department and Postgraduate Studies Committee. Admission is approved by the Postgraduate Studies Committee in consultation with the head of department and the supervisor.

ii) Where admission to the MSc degree study does not follow on a BScHons degree, the minimum period of study for the MSc degree is two years.

b. The MSc degree is conferred on the grounds of a dissertation and such additional postgraduate coursework as may be prescribed.

c. The MSc degree is conferred with distinction to candidates who obtain a final average mark of at least 75% and a mark of at least 75% for the dissertation/mini-dissertation from each of the members of the examination panel. Where a member of the examination panel awards a mark of less than 75% for the dissertation/mini-dissertation, that member of the examination panel must offer, in writing, support for his/her decision, or indicate in writing that he/she supports the examination committee's decision to confer the degree with distinction.

d. Duration of study
Duration of study is a minimum of one year uninterrupted full-time study.

e. Renewal of registration
As long as progress is satisfactory, renewal of the registration of a master's student will be accepted for the second year of the study. Registration for a third and subsequent years will only take place when the Student Administration of the Faculty receives a written motivation that is supported by the head of department and Postgraduate Studies Committee.

f. General
Candidates are required to familiarise themselves with General Regulation G.32.4 regarding the maximum period of registration and G.61 regarding the requirements on the submission of a draft article for publication.

Master of Agricultural Science [MScAgric]

(See also General Regulations G.30 to G.62)

a. Admission to study
In addition to the requirements of General Regulations G.1.3 and G.62, the BScAgric degree is a prerequisite for admission. An average of 60% is required in the final year of the BScAgric degree for admission. Additional requirements and conditions may be prescribed by the Dean on the recommendation of the head of department and the supervisor. Admission is approved by the Postgraduate Studies Committee in consultation with the head of department and the supervisor.

b. Fields of study
The MScAgric degree is conferred in the following fields of study:

- Agronomy
- Agricultural Economics
- Animal Science (Production Management, Production Physiology, Meat Science, Animal Nutrition)
- Entomology
- Extension
- Food Science and Technology
- Genetics
- Horticulture
- Microbiology
- Pasture Science
- Plant Pathology
- Soil Science

c. Duration of study

The duration of study is a minimum of two years uninterrupted full-time study (or three years part-time).

d. Residence

On the recommendation of the head of department, the Dean may set specific residential requirements for the MScAgric degree.

e. Renewal of registration

As long as progress is satisfactory, renewal of the registration of a master's student will be accepted for the second year of the study. Registration for a third and subsequent years will only take place when the Student Administration of the Faculty receives a written motivation which is supported by the head of department and Postgraduate Studies Committee.

f. Curriculum

The curriculum for the MScAgric degree consists of the following:

i) A dissertation; and
ii) Further study in the major subject/s, augmented by ancillary modules prescribed by the Postgraduate Studies Committee, on the recommendation of the head of department. Such ancillary modules may be taken simultaneously with the major subject/s. Candidates in possession of the BScAgricHons degree may be exempted from additional ancillary modules.

g. Examinations and promotion

i) The examinations in the ancillary modules should be successfully completed prior to, or simultaneously with, the examinations in the major subject/s, unless the Faculty Board decides otherwise.
ii) General Regulation G.12.2 applies to the calculation of marks.
iii) In order to obtain the MScAgric degree, the candidate must pass all prescribed modules, including the examination in the major subject/s, as well as the dissertation.

h. Degree with distinction

The MScAgric degree is conferred with distinction on candidates who obtain a final average mark of at least 75% and a mark of at least 75% for the dissertation/mini-dissertation from each of the members of the examination panel. Where a member of the examination panel awards a mark of less than 75% for the dissertation/mini-dissertation, that member of the examination panel must offer, in writing, support for his/her decision, or indicate in writing that he/she supports the examination committee's decision to confer the degree with distinction.

i. General

Candidates are required to familiarise themselves with General Regulation G.32.4 regarding the maximum period of registration and G.61 regarding the requirements on the submission of a draft article for publication.

Master of Agricultural Management [MInstAgrar]

Please refer to the Regulations of the Postgraduate School of Agriculture and Rural Development, page 89.

Master of Consumer Science [MConsumer Science]

(See General Regulations G.30 to G.62)

a. Admission to study
For the MConsumer Science degree in Clothing, Interior, Foods and Nutrition, a four-year BConsumer Science degree that is BCom-based, is required. For the MConsumer Science General, other applicable four-year degrees will be considered. A minimum average of 60% in the broad area of specialisation that the student wishes to pursue is required for admission.

b. Duration of study
A minimum of two years full-time and a maximum of four years part-time study.

c. Degree with distinction
The degree is conferred with distinction on a student who obtains a final average of at least 75%, as well as at least 75% for the dissertation and provided that all the members of the Examination Commission indicate in writing that the degree be conferred with distinction.

Master of Philosophy [MPhil]

Refer to the Regulations of the Centre for Wildlife Management, Department of Animal and Wildlife Sciences available at www.wildlife.up.ac.za

Doctor of Philosophy [PhD]

(Refer to General Regulations G.45 - G.55)

a. Admission to study
In addition to the requirements of General Regulations G.1.3 and G.62, the MSc, MScAgric, MInstAgrar or other appropriate degree is a prerequisite for admission to PhD studies. Additional requirements and conditions can be specified by the Dean on the recommendation of the head of department and the supervisor.

b. Duration of studies (Refer to General Regulation G.51)
The doctorate is conferred on a student only if one of the following periods has expired:
i) At least four years after complying with all the requirements for a three-year bachelor's degree.

ii) At least three years after complying with all the requirements for a four-year bachelor's degree.
iii) At least two years after complying with all the requirements for a bachelor's degree of five years or more.
iv) At least two years after complying with all the requirements for a master's degree.
v) With the exception of a shorter period that may be approved by the dean, at least 12 months since registration for the doctorate at this University have expired. The head of department may set specific residential requirements for students who are required to live on campus.

c. Renewal of registration

Renewal of registration for a PhD student will be accepted for the second and third years of study. Registration for a fourth and subsequent years will only take place when the Student Administration of the faculty receives a written motivation that is supported by the head of department and the Postgraduate Studies Committee.

d. Curriculum

The curriculum for the PhD degree consists of the following:
i) Theoretical knowledge of the major subject/s and such additional modules as may be prescribed.
ii) A thesis.

e. Examinations and promotion

i) General Regulation G.52 applies to the calculation of marks.
ii) In order to obtain the PhD degree the candidate must:
- pass the examinations and the prescribed modules, as determined in the study programme;
- pass the thesis; and
- pass the final examination on the thesis and general subject knowledge.
-

f. Upgrading of MSc studies to PhD

The Faculty supports an effective, fair and flexible system allowing promising students to upgrade from an MSc to a PhD programme, thus ensuring the rapid development and advancement of a dynamic group of researchers in the Faculty. Such a system affords recognition to outstanding postgraduate students (and their projects).

An application to upgrade from an MSc to a PhD programme can only be considered if the candidate provides proof that he/she complies with the requirements for the conferring of an MSc degree. Consequently, upgrading can only be considered if the candidate has completed one year of full-time study for the MSc/MScAgric research degree, and before the expiry of the second year of study.

The application for upgrading has to include the following:
i) An accurate progress report by the candidate on the work done to date for the MSc/MScAgric research project. The report has to provide proof that the findings obtained so far are of such a high standard and great scientific importance that it justifies conversion to a PhD. Any particulars about announcing the findings by means of papers at a conference and/or publication in internationally recognised journals (published or accepted for publication) have to be given in full since special value is attached to such information when considering upgrading.

ii) A detailed project proposal, by the candidate, describing the envisaged PhD project, indicating the objectives of the project, the methodology and the results expected to be achieved.

iii) A recommendation from the project supervisor who should in particular comment on the competence of the applicant as a potential PhD candidate and on the desirability and feasibility of the upgrading, especially with reference to the information supplied by the candidate in his/her submissions [items i) and ii)].

iv) A report from a referee (preferably from abroad, who need not necessarily be the external examiner(s) for the MSc), which is based on the submissions of the candidate and his/her supervisor [items i), ii) and iii)].

v) A recommendation from the head of department, if the head is not the project leader, expounding in particular on the competence of the applicant as a potential PhD candidate and the supervisor as a potential supervisor for a PhD programme.

vi) The head of department submits the candidate's application, together with the reports and recommendations, to the Postgraduate Studies Committee (PGSC) via faculty administration.

vii) The Senate Subcommittee can offer conditional acceptance on the recommendation of the Faculty Board. Within four months after first registration, the doctoral candidate has to present a departmental seminar in which the proposed PhD programme is discussed and at which time he/she will present and attempt to justify in discussion the objectives of the project, the methodology and the envisaged results of the investigation. In the evaluation of this presentation it is preferable to also involve experts from outside the University. Continued registration is subject to departmental confirmation that the candidate does have the requisite insight into and knowledge of the field of study to complete the proposed programme successfully.

viii) In cases where excellent MSc candidates have already published, the Dean may exempt them from certain parts of the prescribed procedures.

g. General

Candidates are required to familiarise themselves with General Regulations G.51, regarding the maximum duration of study, and G.61, regarding the requirements to submit an article/s for publication.

Doctor of Science [DSc] (Code 03260001)

The degree is conferred on a candidate who, on the basis of distinguished and comprehensive research work, enjoys international recognition.

See General Regulation G.56.

1. HONOURS PROGRAMMES IN THE BIOLOGICAL SCIENCES

1.1. BScHons in Biochemistry (Code 03241011)

a. Admission requirements

Organic and Analytical chemistry at 200-level; a final mark of 60% or more in Biochemistry at 300-level.

b. Programme composition

Compulsory modules:

BCM 771	Trends in biochemical research 771	(18 credits)
BCM 773	Research project and report 773	(70 credits)
BCM 774	Research methods 774	(36 credits)
BCM 775	Advanced biochemistry 775	(18 credits)
MLB 721	Molecular and cellular biology 721	(18 credits)

Minimum credits required: 160

Note:

- A pass mark is required for all the components of the honours programme and the average mark is calculated proportionally to the credits.
- Additional modules can be prescribed to remedy deficiencies in a candidate's undergraduate training.

1.2. BScHons in Bioinformatics (Code 03241014)

a. Admission requirements

Students must be in possession of a bachelor's degree in bioinformatics, biological sciences, computer science, informatics, statistics or computer engineering.
Students with a bachelor's degree in either physics, mathematics or electronic engineering may be required to do a special postgraduate bridging year before admission to BScHons in Bioinformatics.

b. Programme composition

Compulsory modules:

BIF 701	Bioinformatics theory and applications	(32 credits)
BIF 702	Trends in bioinformatics and literature seminar	(9 credits)
BIF 703	Research project and report	(35 credits)
MLB 721	Molecular and cellular biology	(18 credits)

Elective modules:

*BIF 704	Introduction to molecular biology for bioinformatics	(18 credits)
*BME 780	Introduction to mathematical statistics for bioinformatics	(18 credits)

Total credits required: 120

***Note:**

Students with degrees in biological sciences should choose BME 780 as an elective. Students from computer science and other related backgrounds should choose BIF 704. Other additional modules may be prescribed for non-degree purposes to address deficiencies in a candidate's undergraduate training.

1.3. BScHons in Biotechnology (Code 02240392)

a. Admission requirements

BSc in Biotechnology or equivalent degree with GTS 352, BCM 351, BCM 354 and MBY 364; an average pass mark of 60% or more at 300-level or permission by the head of department.

b. Programme composition

BScHons in Biotechnology is a unique interdepartmental programme aimed at enabling students to pursue their interest in molecular biotechnology through relevant research areas within the biological sciences, such as biochemistry, molecular virology, plants and their pathogens and genetics. Students within this programme will be registered and will conduct their studies within the department of their choice. A student's choice of research programme will determine which of the respective departments will mentor their honours degree.

BTW 701	Biotechnology in the workplace 701	(18 credits)
MLB 721	Molecular and cellular biology 721	(18 credits)

The curriculum for the balance of the credits will be determined by the heads of department in the biological sciences.

Please consult Prof P Bloomer, Tel: 012 4203259, for further details.

Total credits required: 160

Please note:

- Additional modules may be prescribed by the head of the department, e.g. Advanced academic literacy 300 (EOT 300) where deemed necessary. Honours students may also be required to complete a biometry or equivalent module, if they have not already done so during their undergraduate training.
- A pass mark is required for all the components of the honours study programme and the final mark is calculated proportionally to the credits of the respective prescribed modules.

1.4. BScHons in Entomology (Code 03241031)

a. Programme composition

Code	Module	Credits
Compulsory modules:		
ZEN 701	Research project 701	80
ZEN 702	Research methods 702	16
ZEN 707	Integrated pest management in Africa 707	16
ZEN 713	Scientific communication 713	16
ZEN 782	Insect-plant interactions 782	16
Choice of one additional module:		
ZEN 703	Systematics, evolution and biogeography 703	16

ZEN 704	Ecological and evolutionary physiology 704	16
ZEN 705	Ecology 705	16
ZEN 710	Mammal ecology 710	16
ZEN 712	Behavioural ecology 712	16
ZEN 783	Global climate change and biodiversity 783	16

A pass mark is required for all the components of the honours study programme.

Total credits required: 160

1.5. BScHons in Genetics (Code 03241051)

a. Admission requirements

An average pass mark of 60% or more in at least four genetics modules at 300-level (one of which must be GTS 352) or permission by the head of department.

b. Programme composition

The honours study programmes serve as the first level of postgraduate training and we therefore aim to introduce our students to the methods of research – from the reading of research papers, through to the conceptualization, planning, execution and communication of a research project. The study programme comprises the following modules:

GTK 702	Seminar course 702	(18 credits)
GTK 703	Research project 703	(70 credits)
GTK 704	Trends in genetics 704	(18 credits)
GTK 705	Research methods 705	(36 credits)
MLB 721	Molecular and cellular biology 721	(18 credits)

Total credits required: 160

Please note:

- Additional modules may be prescribed by the head of the department, e.g. Advanced academic literacy 300 (EOT 300) where deemed necessary. Honours students may also be required to complete a biometry or equivalent module, if they have not already done so during their undergraduate training.
- A pass mark is required for all the components of the honours study programme and the final honours mark is calculated proportionally to the credits of the respective prescribed modules.

1.6. BScHons in Microbiology (Code 03240911)

a. Admission requirements

An average pass mark of 60% or more in at least four modules presented by the Department of Microbiology and Plant Pathology at 300-level (one of which must be MBY 364) or permission by the head of department. Note that additional modules may be prescribed by the head of the department where deemed necessary.

b. Programme composition

Compulsory modules:

MCP 751	Research methods 751	(36 credits)
MCP 752	Seminar course 752	(18 credits)
MCP 753	Trends in microbiology 753	(18 credits)
MCP 754	Research project and literature study 754	(70 credits)
MLB 721	Molecular and cellular biology 721	(18 credits)

Total credits required: 160

1.7 BScHons in Plant Science (Code 03241091)

Suitably qualified candidates may also apply for the interdepartmental BScHons in Biotechnology* degree (Code 02240392) with a supervisor in the Department of Plant Science.

a. Admission requirements

BSc in Plant Science, or a recommendation from the head of the department if the candidate did not major in Plant Science.

b. Duration

One academic year for full-time students and two consecutive academic years for part-time students. Lectures and practicals are scheduled to accommodate part-time students.

c. Programme composition

The programme consists of compulsory modules (40 credits) and elective modules (30 credits). Students may register for modules to the maximum of 20 credits presented by another department, which forms part of the elective modules.
The following fields are presented in the BScHons in Plant Science programme:

- Plant Diversity (D) (only 20 elective credits are required for this option)
- Plant Biotechnology/Physiology (PB)
- Plant Ecology (E)
- Option: Medicinal Plant Science (see page 26 for further information)

Apart from the compulsory and elective modules, a project, leading to a research report (50 credits), forms an essential part of the training programme. Two seminars (20 credits each) must also be written and field excursions are undertaken.

In addition to the compulsory modules, electives are selected in consultation with the supervisor.

Programme composition for BScHons in Plant Science:

Code	Module	Sem.	Credits	D	E	PB
BOT 712	Plant nomenclature 712	1	10	**		
BOT 714	Seed ecology 714	1	10		**	
BOT 717	Plant morphology 717	1	10	**		
BOT 718	Introductory plant biotechnology 718	1	10			**

BOT 719	Primary plant metabolism 719	1	10			**
BOT 721	Plant community ecology 721	2	10		**	
BOT 722	General plant ecology 722	2	10		**	
BOT 741	Plant taxonomy 741	2	10	**		
BOT 742	Plant classification 742	2	20	**		
BOT 746	Applications in plant biotechnology 746	2	10			**
BOT 761	Advanced phytomedicine 761	2	10			**
BOT 781	Veld evaluation and management 781	1	10		**	
BOT 782	Research report 782	year	50	*	*	*
BOT 783	Seminar (main) 783	1	20	*	*	*
BOT 784	Seminar (elective) 784	1	20	*	*	*
BOT 786	Plant taxonomy 786	1	10			
BOT 787	Plant dynamics and phenology 787	2	10			
BOT 788	Plant classification 788	2	10			

* Compulsory modules for all students
** Compulsory modules for the discipline of study

Total credits required: 160

1.7. BScHons [Option: Medicinal Plant Science] (Code 03241090)

a. Admission requirements

BSc in Plant Science or a recommendation from the head of department if the candidate did not major in Plant science. A minimum of 60% in Phytomedicine 365 (BOT 365), which is offered at third-year level in the Department of Plant Science.

The recommended modules at BSc third-year level are as follows:

1. BOT 366 Plant diversity (Dept of Plant Science)
2. BOT 356 Plant ecophysiology (Dept of Plant Science)
3. BCM 363 Xeno-biochemistry (Dept of Biochemistry)
4. BCM 355 Immunobiology (Dept of Biochemistry)
5. FAR 382 Pharmacology (Dept of Pharmacology)
6. CMY 282 Physical chemistry (Dept of Chemistry)
7. CMY 284 Organic chemistry (Dept of Chemistry)

b. Duration

The honours degree programme for full-time students covers one academic year and for part-time students two consecutive academic years. Lectures and practicals are scheduled to accommodate part-time students.

c. Learning programme

The programme consists of compulsory modules (30 credits) and elective modules (60 credits). Students may register for modules to the maximum of 20 credits presented by another department, which forms part of the elective modules.

Apart from the compulsory and elective modules, a project, leading to a research report (50 credits), forms an essential part of the programme. One seminar (20 credits) must also be written and field excursions are undertaken. In addition to the compulsory modules, electives are selected in consultation with the supervisor.

Programme composition for BScHons [Option: Medicinal Plant Science]

Code	Module	Sem	Credits
Compulsory modules:			
BOT 761	Advanced phytomedicine 761	2	10
BOT 748	Phytopharmacology 748	1	10
BOT 749	Pharmacognosy/Phytotherapy 749	2	10
BOT 782	Research report 782	year	50
BOT 783	Seminar 783	2	20
Elective modules (to the value of 60 credits):			
BOT 712	Plant nomenclature 712	1	10
BOT 718	Introduction to plant biotechnology 718	1	10
BOT 714	Seed ecology 714	1	10
BOT 719	Primary plant metabolism 719	1	10
BOT 717	Plant morphology 717	1	10
BOT 722	General plant ecology 722	2	10
BOT 746	Applications in plant biotechnology 746	2	10
BOT 741	Plant taxonomy 741	2	10
BOT 742	Plant classification 742	2	20
BOT 781	Veld evaluation and management 781	1	10
BOT 784	Seminar (elective) 784	1	20
BOT 786	Plant taxonomy 786	1	10
BOT 787	Plant dynamics and phenology 787	2	10
BOT 788	Plant classification 788	2	10

Total credits required: 160

1.8. BScHons in Zoology (Code 03241021)

Programme composition

Code	Module	Credits
Compulsory modules:		
ZEN 701	Research project 701	80
ZEN 702	Research methods 702	16
ZEN 713	Scientific communication 713	16

Choice of three additional theory modules:		
ZEN 703	Systematics, evolution and biogeography 703	16
ZEN 704	Ecological and evolutionary physiology 704	16
ZEN 705	Ecology 705	16
ZEN 707	Integrated pest management in Africa 707	16
ZEN 710	Mammal ecology 710	16
ZEN 712	Behavioural ecology 712	16
ZEN 782	Insect-plant interactions 782	16
ZEN 783	Global climate change and biodiversity 783	16

- A pass mark is required for all the components of the honours study programme.

Total credits required: 160

2. MASTER'S PROGRAMMES IN THE BIOLOGICAL SCIENCES

2.1 MSc in Biochemistry (Code 03251011)

Programme composition

BCM 801	Trends in biochemical research 801	(18 credits)
BCM 802	Literature seminar 802	(9 credits)
BCM 890	Project and dissertation 890	(213 credits)

Total credits required: 240

2.2 MSc in Bioinformatics (Code 03251014)

a. Admission requirements

Students must be in possession of a BScHons degree in Bioinformatics or the equivalent thereof.

b. Programme composition

BIF 801	Bioinformatics seminar 801	(18 credits)
BIF 802	Trends in bioinformatics 802	(9 credits)
BIF 803	Bioinformatics research project and report	(213 credits)

Total credits required: 240

2.3 *MSc in Biotechnology (Code 03251052)

*Interdepartmental programme.

Programme composition

Curriculum to be determined by the heads of department in the biological sciences. Please consult with Prof P Bloomer, Tel: 012 4203259, for further details.

Please note:

- Additional modules may be prescribed by the head of department, e.g. Advanced academic literacy 300 (EOT 300), where deemed necessary.

Total credits required: 240

2.4 MSc in Entomology (Code 03251031)

An MSc degree on the grounds of a dissertation.

Programme composition

ENT 890 Dissertation: Entomology 890 (240 credits)

Total credits required: 240

2.5 *MSc[Option: Forest Science] (Code 03251050)

*Interdepartmental programme. Curriculum to be determined by the heads of department in the biological sciences. Please consult with Prof P Chirwa, Tel: 012 4203213, for further details.

a. Admission requirements

A prior four-year bachelor's qualification in Forestry or Forest Science, or an equivalent honours degree in a related field.

b. Programme composition

Curriculum to be determined by the heads of department in the biological sciences. Please consult with Prof B Wingfield, Tel: 012 420 6471 for further details.

FOR 890 Forest science 890 (240 credits)

Please note:

- Additional modules may be prescribed by the head of department, e.g. Advanced academic literacy 300 (EOT 300), where deemed necessary.

Total credits required: 240

2.6 MSc in Genetics (Code 03251051)

Programme composition

GTK 890 Dissertation: Genetics 890 (240 credits)

*GTK 890 also apply to MSc in Biotechnology (code 03251052) students registered in the Genetics department.

Please note:

- Additional modules may be prescribed by the head of department, e.g. Advanced academic literacy 300 (EOT 300), where deemed necessary.

Total credits required: 240

2.7 MSc in Microbiology (Code 03250911)

Programme composition
MBY 890 Dissertation: Microbiology 890 (240 credits)

Total credits required: 240

2.8 MSc in Plant Science (Code 03251091)

a. Admission requirements
BScHons in Plant Science or BScHons [Option: Medicinal Plant Science] with an average of 60%, or a recommendation from the head of department.

b. Programme composition
BOT 890 Dissertation: Plant science 890 (240 credits)

Total credits required: 240
*BOT 890 also apply to MSc in Biotechnology (code 03251052) students registered in the Plant Science department.

2.9 MSc [Option: Medicinal Plant Science] (Code 03251090)

a. Admission requirements
BScHons [Option: Medicinal Plant Science] or a recommendation by the head of department. A minimum of 60% will be necessary in the compulsory modules, BOT 761, BOT 748, and BOT 749, which are offered at honours level in the Department of Plant Science.

b. Programme composition
MPS 890 Dissertation: Medicinal plant science 890 (240 credits)

Total credits required: 240

2.10 MSc in Plant Pathology (Code 03250881)

Programme composition
PPT 890 Dissertation: Plant pathology 890 (240 credits)

Total credits required: 240

2.11 MSc in Zoology (Code 03251021)

Programme composition
ZOO 890 Dissertation: Zoology 890 (240 credits)

Total credits required: 240

3. DOCTORAL PROGRAMMES IN THE BIOLOGICAL SCIENCES

3.1 PhD in Biochemistry (Code 03260012)

Programme composition

BCM 901	Trends in biochemical research 901	(18 credits)
BCM 990	Project and thesis 990	(342 credits)

Total credits required: 360

3.2 PhD in Bioinformatics (Code 03260014)

a. Admission requirements

Students must be in possession of an MSc degree in Bioinformatics or an equivalent thereof.

b. Programme composition

BIF 901	Trends in bioinformatics research	(18 credits)
BIF 990	Thesis: Bioinformatics	(A minimum of 302 credits)

Total credits required: 320 – 480

3.3 *PhD in Biotechnology (Code 03262162)

*Interdepartmental programme.

Programme composition

Curriculum to be determined by the heads of department in the biological sciences. Please consult with Prof P Bloomer, Tel: 012 4203259, for further details.

Total credits required: 360

3.4 PhD in Entomology (Code 03260121)

Programme composition

ENT 900	Entomology 900	
ENT 990	Thesis: Entomology 990	(360 credits)

Total credits required: 360

3.5 *PhD [Option: Forest Science] (Code 03262160)

*Interdepartmental programme.

Programme composition

Curriculum to be determined by the heads of department in the biological sciences. Please consult with Prof P Chirwa, Tel: 012 4203213, for further details.

FOR 990	Forest science	(360 credits)

Total credits required: 360

3.6 PhD in Genetics (Code 03260292)

Programme composition
GTK 900 Genetics 900
GTK 990 Thesis: Genetics 990 (360 credits)

* GTK 900 and GTK 990 also apply to PhD in Biotechnology (code 03262162) students registered in the Genetics department.

Total credits required: 360

3.7 PhD in Microbiology (Code 03260072)

Programme composition
MBY 900 Microbiology 900
MBY 990 Thesis: Microbiology 990 (360 credits)

Total credits required: 360

3.8 PhD in Plant Pathology (Code 03260302)

Programme composition
PPT 900 Plant pathology 900 (50 credits)
PPT 990 Thesis: Plant pathology 990 (350 credits)

Total credits required: 400

3.9 PhD in Plant Science (Code 03261091)

a. Admission requirements
MSc in Plant Science or MSc [Option: Medicinal Plant Science] 60%, or a recommenda-tion from the head of department.

b. Programme composition
BOT 900 Plant science 900
BOT 990 Thesis: Plant science 990 (360 credits)

*BOT 900 and BOT 990 also apply to PhD in Biotechnology (code 03262162) students registered in the Plant Science department.

Total credits required: 400

3.10 PhD [Option: Medicinal Plant Science] (Code 03261090)

a. Admission requirements
MSc [Option: Medicinal Plant Science] or an MSc in Plant Science, or a recommendation from the head of department. A minimum of 60% is required in the compulsory modules, BOT 761, BOT 748, and BOT 749, which are offered at honours level in the Department of Plant Science.

b. Programme composition
MPS 900 Medicinal plant science 900

MPS 990 Thesis: Medicinal plant science 990 (360 credits)

Total credits required: 360

3.11 PhD in Zoology (Code 03261021)

Programme composition
ZOO 900 Zoology 900
ZOO 990 Thesis: Zoology 990 (360 credits)

Total credits required: 360

4. HONOURS PROGRAMMES IN THE PHYSICAL SCIENCES

4.1 BScHons in Chemistry (Code 02240121)

a. Admission requirements
An appropriate BSc degree with at least 60% for Chemistry at 300-level.

b. Duration of programme
The programme normally extends over one year for full-time students. The curriculum comprises an advanced study of the four major fields of chemistry.

c. Closing date for applications
Prospective students must apply for admission to the head of department before **15 December** and will be notified of the outcome by 15 January. Details of the contents of the different modules can be obtained from the head of department.

d. Pass requirements:
A final mark of 50% for each module.

e. Programme composition

Code	Module	Credits
CMY 710	Analytical chemistry 710	28
CMY 711	Organic chemistry 711	28
CMY 712	Inorganic chemistry 712	28
CMY 713	Physical chemistry 713	28
CMY 729	Project 729	48
	Total credits required:	**160**

4.2 BScHons in Engineering Geology and Hydrogeology

Please note that within the honours programme in Engineering Geology and Hydrogeology, there are two possible options, namely Engineering Geology and Hydrogeology. Each has a component of core modules and of elective modules, as shown in the tables below.

Option: Engineering Geology (Code 02240370)

Minimum credits required : 160	
Credits for core modules: 128	**Credits for elective modules: 32**

Core modules (128):			
Code	**Module name**	**Credits**	**Prerequisites**
GTX 713	Site investigation project 713	48	GLY 363/GLY 362
GTX 714	Engineering geology of South Africa 714	16	SGM 311 or TDH
GTX 722	Rock engineering 722	16	GLY 364 or TDH*
GTX 723	Engineering applications 723	16	
GLY 706	Mining methods 706	8	GTX 722 or TDH*
GLY 703	Basin analysis (Tectonics part) 703		
GTX 716	Environmental management and risk assessment 716	16	
Elective modules (32):			
GTX 715	Environmental geochemistry 715	16	
GTX 718	Hydrogeological modelling 718	16	
GTX 721	Construction materials 721	16	
GTX 726	Rock and soil improvement 726	16	GLY 264 or TDH*

Option: Hydrogeology (Code 02240373)

Core modules (~~136~~128):			
Code	**Module name**	**Credits**	**Prerequisites**
GTX 713	Site investigation project 713	48	GLY 362/GLY 363
GTX 714	Engineering geology of South Africa 714	16	SGM 311 or TDH
GTX 715	Environmental geochemistry 715	16	
GTX 719	Contaminant transport 719	16	GTX 715 or TDH*
GLY 706	Mining methods 706	8	
GLY 703	Basin analysis (Tectonics part) 703		
GTX 716	Environmental management and risk assessment 716	16	
Elective modules (32):			
GTX 718	Hydrogeological modelling 718	16	
GTX 722	Rock engineering 722	16	GLY 364 or TDH*
GTX 726	Rock and soil improvement 726	16	

* TDH = permission by Head of Department

4.3 BScHons in Environmental Analysis and Management (Code 02240412)

a. Admission requirements
A BSc degree with suitable majors as recommended by the head of department and 60% average at the 300- and 400-level.

b. Programme composition
Please note that the curriculum may change each year at the discretion of the head of department or the honours co-ordinator in the Department of Geography, Geoinformatics and Meteorology.

Code	Module name	Credits
Fundamental modules:		
ENV 711	Environmental principles 711	20
Core modules:		
ENV 700	Research project 700	30
ENV 703	Research and presentation skills 703	10
Elective modules (to the value of 100 credits):		
GGY 701	Selected theme 701	20
GGY 718	Southern African geomorphology 718	20
ENV 727	Environmental compliance 727	20
ENV 728	Conservation environmental enforcement 728	20
ENV 729	Industrial environmental enforcement 729	20
ENV 785	Environmental impact assessment and auditing 785	20
GGY 789	Environmental change 789	20
ZEN 705	Ecology 705	16
ZEN 710	Mammal ecology 710	16
BOT 721	Plant community ecology 721	10
BOT 722	General plant ecology 722	10
BOT 781	Veld evaluation and management 781	10
Appropriate modules other than the above approved by the honours co-ordinator or head of department may be taken.		

Minimum credits required: 160

4.4 BScHons in Geography (Code 02240411)

a. Admission requirements
An appropriate bachelor's degree, with an overall average of 60% for 300- and 400-level modules.

b. Programme composition
Please note that the curriculum may change each year at the discretion of the head of department or the honours co-ordinator in the Department of Geography,Geoinformatics and Meteorology.

Code	Module name	Credits
Fundamental modules:		
GGY 710	Evolution of geographical thought 710	20
Core modules:		
GGY 702	Geography project 702	30
ENV 703	Research and presentation skills 703	10
Elective modules (to the value of 100 credits):		
GGY 701	Selected theme 701	20
GGY 780	Urban geography of southern Africa 780	20
GGY 718	Southern African geomorphology 718	20
ENV 785	Environmental impact assessment and auditing 785	20
GGY 789	Environmental change 789	20
GGY 793	Geography of land reform 793	20
Appropriate modules other than the above approved by the honours co-ordinator or head of department may be taken.		

Minimum credits required: 160

4.5 BScHons in Geoinformatics (Code 02240408)

a. Admission requirements

A BSc in Geoinformatics degree or applicable BSc degree with relevant experience in computer programming, data management and spatial analysis. In the latter case prospective students will be required to do additional modules to enable them to reach the desired level of study. Selection takes place before admission.

b. Programme composition

Students can choose from the following modules in consultation with the programme manager:

Code	Module name	Credits
Compulsory for all students:		
ENV 703	Research and presentation skills 703	10
Core modules:		
UNI 763	Internet GIS 763	20
UNI 766	Spatial statistics and geodesy 766	20
UNI 787	GIS logistics and data acquisition787	20
UNI 791	GIS professional practice 791	20
UNI 792	GIS project 792	30
GMA 705	Advanced remote sensing 705	20
COS 787	Spatial databases 787	15
Modules offered by other Departments can also be selected in consultation with the programme manager		

Minimum credits required: 155

4.6 BScHons in Geology (Code 02240141)

Programme composition

Code	Core modules	Credits
GLY 702	Fluid-rock interaction 702	16
GLY 703	Basin analysis 703	16
GLY 704	Crustal evolution 704	16
GLY 706	Mining methods 706	8
GLY 707	Mapping camp 707	8
GLY 710	Honours project 710	32
GLY 711	Igneous petrology and geochemistry 711	16
GLY 712	Metamorphic petrology and geochemistry 712	16
GLY 713	Economic geology 713	16
GLY 714	Mineralogy 714	16

Total credits required: 160

4.7 BScHons in Meteorology (Code 02240070)

a. Admission requirements

A BSc: in Meteorology degree **OR**
An appropriate bachelor's degree with second-year mathematics and first-year physics.

WKD 151 Atmospheric processes
WKD 152 Atmospheric circulation and climate
WKD 162 Dynamic and numerical meteorology
WKD 164 Climate and weather of Southern Africa
WKD 250 Weather forecasting
WKD 261 Physical meteorology
WKD 351 Atmospheric balance laws
WKD 352 Atmospheric vorticity and divergence
WKD 361 Quasi-geostrophic analysis
WKD 362 Cloud and boundary layer dynamics
WKD 365 Atmospheric data manipulation
WTW 114 Calculus*
WTW 128 Calculus*
WTW 126 Linear algebra*
WTW 218 Calculus*
PHY 171 First course in physics* or PHY 114 and 124
(* or an equivalent qualification as approved by the head of the department.)

Core modules	Elective modules	Total credits
120 credits	40 credits	160 credits

Code	Module	Credits
Core modules:		
WKD 706	Dynamic meteorology 706	20
WKD 704	Numerical modelling: Applications 704	20

WKD 731	Overview of tropical and mid-latitude meteorology 731	20
WKD 732	Convective weather 732	20
WKD 763	Research project 763	40
Elective modules:		
WKD 703	Seasonal climate modelling 703	20
WKD 705	Numerical modelling: Basic concepts 705	20
WKD 708	Cloud microphysics 708	20
WKD 761	Basic concepts of remote sensing	20
WKD 719	Boundary layer meteorology 719	20
WKD 781	Cloud dynamics 781	20

Total credits required: 160

4.8 BScHons in Physics (Code 02240231)

a. Admission requirements

BSc (or equivalent qualification) with a minimum of 60% in physics at third-year level and with permission from the head of department.

b. Programme composition

Code	Module name	Lectures	Credits
FSK 700	Physics 700	240	160

Students registered for the BScHons in Physics degree enrol for Physics 700. The programme comprises 160 credits and consists of 240 lectures. It also includes a research project, which is resulted in a seminar presentation. The programme may optionally include an advanced experimental work.

The curriculum is compiled in consultation with the Head of the Department of Physics, from whom details are available. With permission from the head of department a maximum of 30 credits may be taken from other postgraduate modules from other departments.

The modules listed below may be taken by students in other honours degree programmes. They must, however, first consult with the Head of the Department of Physics about the availability of a particular module in a particular year.

Postgraduate physics modules:

Code	Module name	Lectures	Credits
PHY 701	Mathematical methods 701	30	15
PHY 702	Classical mechanics 702	30	15
PHY 703	Quantum mechanics 703	30	15
PHY 704	Statistical physics 704	30	15
PHY 705	Electrodynamics 705	30	15
PHY 706	Project and seminar 706		15

PHY 708	Many body physics 708	30	15
PHY 710	Numerical physics 710	30	15
PHY 711	Solid state physics 711	30	15
PHY 712	Quantum optics 712	20	10
PHY 713	Electronic materials 713	30	15
PHY 714	Analytical physics 714	30	15
PHY 716	Group theory 716	20	10
PHY 717	Quantum field theory 717	20	10
PHY 718	Experimental physics 718 (5 experiments)		15
PHY 719	Nuclear physics 719	20	10
PHY 781	Foundations of physics 781	20	10
PHY 782	Current trends in physics 782	30	30

5. MASTER'S PROGRAMMES IN THE PHYSICAL SCIENCES

5.1 MSc in Applied Mineralogy (Code 02250381)

Programme composition
TMN 890 Dissertation: Applied mineralogy 890 (200 credits)
Selected additional coursework as prescribed by the head of the department.

Total credits required: 200
In addition to the dissertation, coursework may be required and prescribed by the head of the department according to the needs and background of the individual MSc student.

5.2 MSc in Chemistry (Code 02250121)

Programme composition
CHM 890 Dissertation: Chemistry 890 (200 credits)

Total credits required: 200

5.3 MSc in Engineering Geology (Code 02250371)

Programme composition
IGL 890 Dissertation: Engineering geology 890 (200 credits)

Total credits required: 200

5.4 MSc in Engineering and Environmental Geology (Code 02250372)

Programme composition
IGL 890 Dissertation: Engineering geology 890 (200 credits)

Total credits required: 200

5.5 MSc: Exploration Geophysics (Code 02250431)

Programme composition

EGF 890	Dissertation: Exploration geophysics 890	(240 credits)

5.6 MSc in Geography (Code 02250411)

Programme composition

GGF 890	Dissertation: Geography 890	(240 credits)

Total credits required: 240

5.7 MSc in Geoinformatics (Code 02250412)

Programme composition

GIS 890	Dissertation: Geoinformatics 890	(240 credits)

Total credits required: 240

5.8 MSc in Geology (Code 02250141)

Programme composition

GLG 890	Dissertation: Geology 890	(240 credits)

Total credits required: 240

5.9 MSc in Meteorology (Code 02250070)

Programme composition

AWM 890	Dissertation: Meteorology 890	(240 credits)

Total credits required: 240

5.10 MSc in Physics (Code 02250231)

a. Admission requirements

BScHons in Physics (or equivalent qualification) and with permission from the head of department.

b. Programme composition and credit requirements:

240 credits consisting of:

i) Dissertation (determined by supervisor and head of department)

ii) Theoretical modules (maximum of 60 lectures) may be taken and are determined by the supervisor and head of department. These modules are to supplement the subject of the dissertation of the student.

FSK 890	Dissertation: Physics 890	(210 credits)
PHY 891	Relevant courses 891	(30 credits)

6. DOCTORAL PROGRAMMES IN THE PHYSICAL SCIENCES

6.1 PhD in Chemistry (Code 02260451)

Programme composition

CHM 900	Chemistry 900	
CHM 990	Thesis: Chemistry 990	(360 credits)

Total credits required: 360

6.2 PhD in Engineering and Environmental Geology (Code 02260542)

Programme composition

IGL 900	Engineering geology 900	
IGL 990	Thesis: Engineering geology 990	(360 credits)

Total credits required: 360

6.3 PhD in Exploration Geophysics (Code 02260531)

Programme composition

EGF 900	Exploration geophysics 900	
EGF 990	Thesis: Exploration geophysics 990	(480 credits)

Total credits required: 480

6.4 PhD in Geography (Code 02260511)

Programme composition

GGF 900	Examination: Geography 900	
GGF 990	Thesis: Geography 990	(480 credits)

Total credits required: 480

6.5 PhD in Geoinformatics (Code 02260512)

Programme composition

GIS 900	Examination: Geoinformatics 900	
GIS 990	Thesis: Geoinformatics 990	(480 credits)

Total credits required: 480

6.6 PhD in Geology (Code 02260521)

Programme composition

GLG 900	Geology 900	
GLG 990	Thesis: Geology 990	(360 credits)

Total credits required: 360

6.7 PhD in Meteorology (Code 02260630)

Programme composition
AWM 900 Meteorology 900
AWM 990 Thesis: Meteorology 990 (480 credits)

Total credits required: 480

6.8 PhD in Physics (Code 02260481)

a. Admission requirements
An MSc in Physics (or equivalent qualification) and with permission from the head of department.

b. Progamme composition and credit requirements:
FSK 990 Thesis: Physics 990 (360 credits)

Additional modules may be prescribed by the head of department. The contents of the coursework will be determined by the supervisor and head of department to supplement the subject of the thesis of the student.

Total credits required: 360

7. BSC HONOURS PROGRAMMES IN THE AGRICULTURAL AND FOOD SCIENCES

7.1 BScHons in Animal Science (Code 03241201)

The BScHons (Animal Science) degree covers one academic year (two semesters) of full-time study. The admission requirements are a BSc (Animal Science) degree or equivalent qualification. A South African equivalent aggregate mark of 60% is usually required for all the modules taken in the final year of undergraduate studies. Determination, attitude and standard of undergraduate projects, where available, will also be taken into consideration. Students are selected on merit.

The honours degree consists of the following compulsory modules:

TLR 700	Animal breeding and genetics 700	(24 credits)
VGE 703	Animal nutrition 700	(50 credits)
PFS 700	Production physiology 700	(22 credits)
VKU 700	Animal science 700	(70 credits)

A minimum of **166 credits** is required to obtain the degree.

Note: A pass mark is required for all the components of the honours programme and the average mark is calculated proportionally to the credits.
Additional modules can be prescribed to remedy shortcomings in a candidate's undergraduate training, notably BME 210 and GKD 250.

7.2 BScHons in Food Science (Code 03240921)

a. Admission requirements

A BSc in Food Science degree with a pass mark of at least 60%. A candidate with another, applicable academic background can be admitted to the programme on passing a preliminary examination and/or on completion of certain prescribed modules aimed at supplementing lacking background knowledge.

b. Duration

One year full-time.

c. Programme composition

Compulsory modules (120 credits):

FST 700	Research methodology and seminars 700 (year module)	(20 credits)
FST 712	Sensory evaluation 712	(10 credits)
FST 713	Product development and quality management 713	(30 credits)
FST 720	Advanced food science 720	(20 credits)
FST 763	Research project 763 (year module)	(40 credits)

Elective modules (40 credits):

Each candidate must complete elective modules to a total of 40 credits.
We strongly recommend the following two modules as electives, or other modules as approved by the head of department:

FST 701	Animal food technologies 701	(20 credits)
FST 702	Advanced plant food science and technologies 702	(20 credits)

Total credits required: 160

7.3 BScHons in Nutrition and Food Science (Code 03240922)

a. Admission requirements

A BSc in Nutrition and Food Science degree with a pass mark of at least 60%. A candidate with another, applicable academic background can be admitted to the programme on passing a preliminary examination and/or on completion of certain prescribed modules aimed at supplementing lacking background knowledge.

b. Duration

One year full-time.

c. Composition of the programme

FST 700	Research methodology and seminars 700	(20 credits)
FST 712	Sensory evaluation 712	(10 credits)
VDS 713	Recipe development and standardisation 713	(30 credits) **or**
FST 713	Product development and quality management 713	(30 credits)
VVW 720	Advanced nutrition and food science 720	(20 credits)
VVW 763	Research project 763	(45 credits)
VDS 723	Food consumerism and product advice 723	(15 credits)
VVW 765	Micronutrient malnutrition 765	(20 credits)

Total credits required: 160

7.4 BScHons in Soil Science [Option: Environmental Soil Science] (Code 03240902)

a. Admission requirements

In addition to the requirements of General Regulations G.1.3 and G.62, an appropriate bachelor's degree is a prerequisite. Soil science at an undergraduate level is required, namely: Introductory soil science, Pedology and Soil chemistry. It is at the discretion of the head of department to prescribe any other modules deemed necessary, or to exempt a prospective student from specific requirements.

b. Programme composition

The honours degree is awarded on the basis of formal modules passed. Students registered for the BScHons in Soil Science [Option: Environmental Soil Science] will register for all the soil science modules prescribed at honours level, as well as any other modules deemed necessary by the head of department.

The following core modules are prescribed:

AGR 785	Crop production systems (I): Field crops 785	(15 credits)
GDK 771	Advanced environmental soil chemistry 771	(15 credits)
GDK 772	Advanced environmental soil physics 772	(15 credits)
GDK 773	Plant nutrition, soil biology and soil fertility 773	(15 credits)
GDK 775	Project in environmental soil science 775	(20 credits)
LKM 750	Environmental biophysics 750	(15 credits)
PGW 702	Scientific communication 702	(30 credits)
PGW 704	Research methodology 704	(15 credits)
WDE 750	Environmental resource assessment and management 750	(20 credits)

Total credits required: 160

7.5 BScHons in Wildlife Management (Code 03241001)

a. Admission requirements

To qualify for admission to the BScHons (Wildlife Management), prospective students must have completed a BSc degree with Animal Science, Ecology, Zoology, Plant Science, or a similar relevant biological major subject; or a BScAgric (Animal Sciences and/or Plant Production); a BSc (Forestry), a BVSc degree, or a similar degree. The candidate must also furnish proof of having passed a relevant module in statistics, otherwise they must register for one separately. A South African equivalent aggregate mark of 60% is usually required for all the modules taken in the final year of undergraduate studies. Determination, attitude and standard of undergraduate projects, where available, will also be taken into consideration. Students are selected on merit.

b. Closing date for applications

All applications for admission should reach the Client Service Centre, University of Pretoria, Pretoria, 0002 or the Director of the Centre for Wildlife Management by **30 October** of the preceding year.

c. Duration of the programme

The programme extends over one academic year, full-time.

d. Programme composition

The curriculum is compiled in consultation with the Director of the Centre for Wildlife Management from the modules listed below or any other relevant modules. The programme includes lectures/discussions, seminars, a research project (paper), excursions and informal seminars/lectures. A final mark of at least 50% is required in each of the modules listed for this honours degree.

The honours programme comprises a minimum of 160 credits:

Code	Module name	Credits
NLB 780	Animal population dynamics	5
NLB 781	Wildlife management principles and techniques	5
NLB 782	Wildlife nutrition	10
NLB 783	Parasites, diseases and the capture of wildlife animals	10
NLB 784	Mammal science	5
NLB 785	Seminar	5
NLB 795	Research project	50
BOT 781	Veld evaluation and management	10
BOT 785	Vegetation of South Africa	10
BOT 786	Plant taxonomy	10
BOT 787	Plant dynamics and phenology	10
BOT 788	Plant classification	10
GDK 779	Basic soil science	10
WDE 701	Range management in wildlife systems	10
	Total credits required:	**160**

8. MASTER'S PROGRAMMES IN THE AGRICULTURAL AND FOOD SCIENCES

8.1 MConsumer Science

There are two options available, each requiring a minimum of 240 credits:

Dissertation option:
Interior Merchandise Management (02253004)
Clothing Management (02253006)
Food Management (02253008)
General (02253009)

Coursework option:
Interior Merchandise Management (02253003)
Clothing Management (02253005)
Food Management (02253007)
General (02253010)

a. Admission requirements

For the MConsumer Science degree with specialisation in Clothing, Interior, Foods and Nutrition, a four-year BConsumer Science degree that is BCom-based is required. A minimum average of 60% in the broad area of specialisation that the student wishes to pursue is required for admission.
For the general MConsumer Science degree other applicable four-year degrees will be considered.

b. Duration of study

A minimum of two years full-time and a maximum of four years part-time study.

c. Programme composition

Dissertation option:

NMN 814 Research methodology 814	(30 credits)
Theoretical framework	(15 credits)*
Electives (a minimum of 30-45 credits, of which 30 credits must be from the Department of Consumer Science	(30 credits each)
VBR 890 Dissertation: Consumer Science 890	(150 credits)

Coursework option:

NMN 814 Research methodology 814	(30 credits)
Theoretical framework	(15 credits)*
Electives (a minimum of 120-135 credits, of which 60 credits must be from the Department of Consumer Science)	(30 credits each)
VBR 892 Research report: Consumer Science 892 (Mini-dissertation)	(60 credits)

*To earn credits for theoretical frameworks one of the following modules can be taken:

HSK 810	Theoretical frameworks in cultural studies 810	(15 credits)
HSK 812	Theoretical frameworks in consumer studies 812	(15 credits)
HSK 813	Socio-cultural studies 813	(15 credits)

Other applicable theoretical frameworks offered in and outside the Department can be taken with the approval of the postgraduate committee of the Department.

Depending on the study, a maximum of two postgraduate modules may be selected from disciplines in other departments.

Students who hold an honours degree related to one of the chosen specialisation areas, may apply for exemption of certain modules. The level and scope of the modules will be considered for exemption purposes.
Depending on the academic background of the student and the chosen area of study, it may be required of the student to do additional coursework.
A basic course in statistics is compulsory when a quantitative approach is used for the research for the dissertation/mini-dissertation.
Work on the dissertation/mini-dissertation consists of three parts, namely a research proposal, project execution, and writing the research report (dissertation/mini-dissertation). It is compulsory to give an oral presentation of the proposal as well as of the research on completion of the degree.

Electives for the different areas of specialisation:

Interior merchandise management programmes	
First semester electives	**Second semester electives**
ITW 881 Equipment studies 881 (30 credits)	ITW 880 Interior merchandise 880 (30 credits)

TKS 881 Textiles and quality control 881 (30 credits	ITW 882 Socio-psychological aspects of housing and interior 882 (30 credits)
VBF 811 Consumer facilitation 811 (30 credits)	

Clothing management programmes	
First semester electives	**Second semester electives**
KLD 880 Social aspects of clothing 880 (30 credits	KLD 883 Clothing: Product development 883 (30 credits
TKS 881 Textiles and quality control 881 (30 credits	KLD 884 Clothing merchandising manage-ment 884 (30 credits)

Food management programmes	
First semester electives	**Second semester electives**
VDS 880 Social aspects of foods 880 (30 credits	VDS 883 Consumer aspects of food product design and development 883 (30 credits)
VDS 881 Foods merchandising 881	VDG 881 Nutritional assessment and status 881 (30credits
VDG 880 Contemporary aspects of nutrition 880 (30 credits	VVW 765 Micronutrient malnutrition 765 (20 credits
VDB 880 Menu planning 880 (30 credits	
VDB 881 Quality management in food service systems 881 (30 credits	

General programmes*	
First semester electives	**Second semester electives**
VBF 811 Consumer facilitation 811	ITW 880 Interior merchandise 880 (30 credits
VDS 880 Social aspects of foods 880 (30 credits	ITW 881 Equipment studies 881 (30 credits
*Subjects from the other fields of specialisation may be included in this particular programme	ITW 882 Socio-psychological aspects of housing and interior 882 (30 credits
	KLD 880 Social aspects of clothing 880 (30 credits

Electives outside the department
The following electives can be considered for certain programmes or are prerequisites for certain electives:

Code	Module name	Credits
ENP 812	Business plan 812	20
ENP 821	Introduction to entrepreneurship 821	20
BEM 781	Marketing management 781	20
KBE 780	Entrepreneurship 780	20
TBE 711	Strategic tourism management 711	20
TBE 713	Hospitality management 713	20
TBE 811	Strategic tourism management 811	20
VVW 765	Micronutrient malnutrition 765	20
AGV 726	Extension programme planning and management 726	20
AGV 728	Extension programme evaluation 728	20
AGV 729	Human and organisational behaviour change and management 729	20

Prerequisites for electives
The following orientation/s or elective/s from other departments is/are prerequisites for (a) particular elective/s:

Prerequisite(s)	Elective
HSK 810 Theoretical frameworks in cultural studies 810; **and/or** HSK 813 Socio-cultural studies 813	KLD 880 Social aspects of clothing 880
HSK 812 Theoretical frameworks in consumer studies 812	ITW 880 Interior merchandise 880
HSK 812 Theoretical frameworks in consumer studies 812	ITW 881 Equipment studies 881
HSK 810 Theoretical frameworks in cultural studies 810; **and/or** HSK 813 Socio-cultural studies 813 HSK 812 Theoretical frameworks in consumer studies 812	ITW 882 Socio-psychological aspects of housing and interior 882
HSK 812 Theoretical frameworks in consumer studies 812	VBF 811 Consumer facilitation 811
HSK 810 Theoretical frameworks in cultural studies 810	VDS 880 Social aspects of foods 880
BEM 781 Marketing management 781	VDS 881 Foods merchandising 881
HSK 812 Theoretical frameworks in consumer studies 812	VDS 883 Consumer aspects of food product design and development 883

8.2 MPhil in Wildlife Management (Code 03250700)

a. Admission

Students wishing to register for the MPhil (Wildlife Management) should have obtained an approved four-year first degree at a recognised university or any qualification that is accepted by the Senate as equivalent to it in terms of Regulation G.62.

b. Duration

The programme extends over two years. The theoretical component forms 40%, the research project 35% and the practical component 25% of the programme.

c. Programme composition

This programme is aimed at candidates interested in this field but who come from various non-biological backgrounds. It is a postgraduate programme focusing on the philosophy, ethics, ecological principles and application of wildlife management.

Compulsory theoretical modules		**Credits**
NLB 871	The philosophy, principles and ethics of wildlife management 871	10
NLB 872	Man and nature conservation 872	5
NLB 873	Veld management 873	7
NLB 874	Plant identification 874	5
NLB 875	Vegetation dynamics 875	5
NLB 876	Reptile biology and identification 876	5
NLB 877	Mammalogy 877	5
NLB 878	Wildlife nutrition 878	10
NLB 879	Wildlife management techniques 879	6
NLB 880	Parasites and diseases of wildlife 880	5
NLB 881	Game ranch and nature reserve economics 881	5
NLB 882	Animal population dynamics 882	7
NLB 883	Ecotourism 883	7
NLB 884	Wildlife and the law 884	7
NLB 885	Wildlife utilisation 885	7
NLB 886	Practical studies 886	60
NLB 887	Research project 887	84
	Total credits required:	**240**

8.3 MSc in Food Science (Code 03250921)

Programme composition

The degree is conferred based on a dissertation and other requirements as follows:

FST 801 Advanced food science 801 (20 credits)
Any one module and/or assignment(s) at the advanced level chosen in consultation with the head of department.

FST 890 Dissertation: Food science 890 (220 credits)
Each candidate must write a dissertation on his/her research project in food science and/or food technology and at least a concept research paper for publication in a peer-reviewed scientific journal.

Total credits required: 240

8.4 MSc in Nutrition (Code 03251106)

Programme composition
The degree is conferred based on a dissertation and 60 credits of coursework.

VDG 801 Electives: Nutrition 801 (60 credits)
Modules at the advanced level chosen in consultation with the Director of the Centre for Nutrition and the head of department. See list of modules below.

VDG 890 Dissertation: Nutrition 890 (180 credits)
Each candidate must write a dissertation on his/her research project in Nutrition and at least a concept research paper for publication in a peer-reviewed scientific journal.

List of elective modules – choose modules to the value of 60 credits

VDS 880	Social aspects of foods 880	(30 credits)
VDS 881	Foods merchandising 881 *Prerequisite*: *Consult the head of department*	(30 credits)
VDS 883	Consumer aspects of food product design and development 883 *Prerequisites: HSK 812 (Theoretical frameworks in consumer studies)*	(30 credits)
VDG 880	Contemporary aspects of nutrition 880 *Prerequisites: Consult the head of department*	(15 credits)
VDG 881	Nutritional assessment and status 881 *Prerequisites: Consult the head of department*	(30 credits)
DEK 802	Seminar meetings 802	(15 credits)
DEK 803	Literature studies 803	(15 credits)
PFS 801	Production physiology 801	(30 credits)
PFS 802	Production physiology 802	(30 credits)
VLE 801	Meat science 801	(30 credits)
VLE 802	Meat science 802	(30 credits)
VGE 801	Monogastric nutrition 801	(30 credits)
VGE 802	Ruminant nutrition 802	(30 credits)

Total credits required: 240

8.5 MSc in Soil Science (Code 03250901)

Programme composition

GDK 800 Soil science 800	(80 credits)
GDK 890 Dissertation: Soil science	(160 credits)

Total credits required: 240

8.6 MSc in Wildlife Management (Code 03251001)

Programme composition
NLB 890: Dissertation: Wildlife management 890 (240 credits)

Research project with dissertation. Please contact the Acting Director: Centre for Wildlife Management; Prof W van Hoven, on Tel: 012 4202569 for the available options.

Total credits required: 240

8.7 MScAgric in Agricultural Economics (Code 03250041)

The requirements for the master's degree are the following:
i) Modules to be determined in conjunction with the Head of Department: Minimum of 150 credits.
ii) Completion of a required module in research methodology EBW 801 and a dissertation based on research under the guidance of a member of the academic staff of the department (LEK 890: Dissertation: Agricultural economics 890 – 180 credits).

Programme composition

FIRST YEAR

Code	Module	Credits
Core modules:		
MIE 780	Microeconomics 780	20
EKT 713	Econometrics 713	20
LEK 711	Advanced production economics 711	15
EKT 723	Econometrics 723	20
LEK 882	Institutional economics 882	15

Elective modules (According to area of specialisation):		
Environmental economics:		
LEK 886	The economics of natural resources 886	15
Two electives from:		
LEK 814	Agricultural economics: Quantitative models for agricultural policy 814	15
LEK 780	Introduction to natural resource and environmental economics 780	15
LEK 785	Agricultural project planning and appraisal 785	15
LEK 826	Environmental valuation and policy 826	15
Any other elective of relevance to environmental economics		

Agricultural and rural finance:		
LEK 722	Agricultural finance and risk management 722	15
LEK 784	Advanced rural finance 784	15
Two electives from:		
LEK 712	Agricultural policy analysis 712	15
LEK 723	Issues in agricultural and applied economics 723	15
LEK 785	Agricultural project planning and appraisal 785	15
Any other elective in Financial management		

Agribusiness management:		
Any four electives from:		
IEK 780	International economics 780	20
LEK 713	Agricultural marketing 713	15
LEK 720	Agribusiness management 720	15
LEK 722	Agricultural finance and risk management 722	15
LEK 782	International agricultural trade and policy 782	15
LEK 785	Agricultural project planning and appraisal 785	15
LEK 883	Agricultural supply chain management 883	15

Agricultural policy analysis:		
Required:		
LEK 712	Agricultural policy analysis 712	15
MEK 780	Macroeconomics 780	15
Any two electives from:		
IEK 780	International economics 780	20
LEK 723	Issues in agricultural and applied economics 723	15
LEK 782	International agricultural trade and policy 782	15
LEK 785	Agricultural project planning and appraisal 785	15
LEK 820	Partial equilibrium modelling and commodity market analysis 820	15
LEK 832	Agricultural science and technology policy 832	15
LEK 833	Food policy 833	15
LEK 834	Measuring and monitoring food security 834	15

SECOND YEAR

Required modules:		
EBW 801	Research methodology 801	
LEK 890	Dissertation: Agricultural economics 890	180

Minimum total credits for master's degree over two years: 330

8.8 MScAgric in Agricultural Extension (Code 03251030)

Programme composition

All the Extension or similar substitutable modules must be completed:

Code	Module	Credits
ARD 780	Rural development studies 780	40
AGV 712	Leadership and group dynamics 712	20
AGV 713	Communication for sustainable rural development 713	20
AGV 715	Principles and approaches of rural development and extension 715	20
AGV 726	Extension programme planning and management 726	20
AGV 728	Extension programme evaluation 728	20
AGV 729	Human and organisational behaviour change and management 729	20
	Subtotal credits	**160**
AGV 800	Agrarian extension 800 (Research leading to a dissertation)	20
AGV 890	Dissertation: Agrarian extension 890 (A dissertation based on appropriate research in the field of Extension)	180
	Total credits required	**360**

8.9 MScAgric in Agronomy (Code 03250454)

Programme composition

AGR 800 Agronomy 800 (80 credits)
AGR 890 Dissertation: Agronomy 890 (160 credits)

Total credits required: 240

8.10 MScAgric in Animal Science degrees

8.10.1 Animal Breeding and Genetics (Code 03250457)
8.10.2 Nutrition Science (Code 03250421)
8.10.3 Meat Science (Code 03250122)
8.10.4 Production Management (Code 03250441)
8.10.5 Production Physiology (Code 03250391)

a. Programme composition (8.10.1 – 8.10.5)

The curriculum for the MScAgric degree consists of the following:

i) A dissertation; and
ii) Advanced study in the major subject/s, augmented by ancillary modules to the maximum of 120 credits that may be prescribed by the Dean on the recommendation of the head of department. Such ancillary modules may be taken simultaneously with the major subject/s. Candidates in possession of the BScAgricHons degree may be exempted from additional ancillary modules.

VKU 801: Animal Science 801 (120 credits)
Consisting of a maximum of 120 credits of coursework selected from Animal science modules on 800-level or other relevant modules (See list below):

GVK 800	Large stock science 800	(30 credits)
KVK 800	Small stock science 800	(30 credits)
PVK 800	Poultry science 800	(30 credits)
PFS 801	Production physiology 801	(30 credits)
PFS 802	Production physiology 802	(30 credits)
TLR 801	Animal breeding and genetics 801	(30 credits)
TLR 802	Animal breeding and genetics 802	(30 credits)
VKD 800	Pig science 800	(30 credits)
VNE 800	Livestock ecology 800	(30 credits)
VLE 801	Meat science 801	(30 credits)
VLE 802	Meat science 802	(30 credits)
VGE 801	Monogastric nutrition 801	(30 credits)
VGE 802	Ruminant nutrition 802	(30 credits)
WLK 800	Wool science 800	(30 credits)

VKU 890: Dissertation: Animal science 890 (240 credits)
Dissertation of 240 credits or a mini-dissertation of 120 credits.

Total credits required: 240

8.11 MScAgric in Entomology (Code 03250120)

Programme composition
ENT 890 Dissertation: Entomology 890 (240 credits)

Total credits required: 240

8.12 MScAgric in Food Science and Technology (Code 03250261)

a. Admission requirements
BScAgric or equivalent degree.

b. Programme composition
The degree is conferred based on a dissertation and other requirements as follows:

FST 801 Advanced food science 801 (20 credits)
Any one module and/or assignment(s) at the advanced level chosen in consultation with the head of department.

FST 890 Dissertation: Food science 890 (220 credits)
Each candidate must write a dissertation on his/her research project in Food science and/or Food technology and at least a concept research paper for publication in a peer-reviewed scientific journal.

Total credits required: 240

8.13 MScAgric in Genetics (Code 03250291)

Programme composition
GTK 890 Dissertation: Genetics 890 (240 credits)

Students registered for the MScAgric programme will be required to complete ancillary modules concurrently with the abovementioned dissertation during their first year of registration. These modules will be selected from the Genetics honours modules (700-level). Candidates in possession of a BScAgricHons may be exempted from these modules.

Please note:
- Additional modules may be prescribed by the head of department, e.g. Advanced academic literacy 300 (EOT 300), where deemed necessary.

Total credits required: 240

8.14 MScAgric in Horticulture (Code 03250091)

Programme composition
TBK 800 Horticultural science 800 (80 credits)
TBK 890 Dissertation: Horticultural science 890 (160 credits)

Total credits required: 240

8.15 MScAgric in Microbiology (Code 03250071)

Programme composition
MBY 890 Dissertation: Microbiology 890 (240 credits)

Total credits required: 240

8.16 MScAgric in Pasture Science (Code 03250455)

Programme composition
WDE 800 Pasture science 800 (80 credits)
WDE 890 Dissertation: Pasture science 890 (160 credits)

Total credits required: 240

8.17 MScAgric in Plant Pathology (Code 03250301)

Programme composition
PPT 890 Dissertation: Plant pathology 890 (240 credits)

Total credits required: 240 credits

8.18 MSc in Postharvest Technology (Code 03251102)

Programme composition
The degree is awarded based on a mini-dissertation and one elective module:

PLG 801 Elective coursework 801 (140 credits)
PLG 802 Mini-dissertation 802 (100 credits)

Total credits required: 240 credits

8.19 MScAgric in Soil Science (Code 03250456)

Programme composition
GDK 800 Soil science 800 (80 credits)
GDK 890 Dissertation: Soil science 890 (160 credits)

Total credits required: 240

9. DOCTORAL PROGRAMMES IN THE AGRICULTURAL AND FOOD SCIENCES

9.1 PhD in Agrarian Extension (Code 03262002)

Programme composition
The programme consists of:
i) Original research leading to a thesis.
ii) An examination on the thesis.

AGV 900 Agrarian extension 900
AGV 990 Thesis: Agrarian extension 990 (360 credits)

Total credits required: 360

9.2 PhD in Agricultural Economics (Code 03260042)

The PhD programme in Agricultural Economics consists of a thesis and an oral examination:

LEK 900 Agricultural economics 900 (80 credits)
LEK 990 Thesis: Agricultural economics 990 (480 credits)

All students need to follow a preparatory programme for the thesis which is not part of the degree programme. This preparatory programme should at least cover the following modules or their equivalents:

EKN 812 Microeconomics 812 (15 credits)
EKN 813 Macroeconomics 813 (15 credits)
EKT 816 Econometrics 816 (15 credits)
LEK 814 Agricultural economics: Quantitative models for agricultural policy 814 (15 credits)

If these modules or their equivalents are successfully completed and a PhD proposal been successfully presented and approved by the Department's postgraduate committee, the student may proceed to the research phase and the thesis.

LEK 990 Thesis: Agricultural economics 990 (480 credits)

For students with an MInstAgrar or similar qualification, additional modules might be recommended in order to ensure that the candidates' quantitative abilities are at the same level as someone entering the programme with an MScAgric.

Total credits required: 560

9.3 PhD in Agronomy (Code 03262164)

Programme composition

AGR 900 Agronomy 900 (60 credits)
AGR 990 Thesis: Agronomy 990 (300 credits)

Total credits required: 360

9.4 PhD in Animal Science (Code 03260141)

Programme composition

The curriculum for the PhD degree programme consists of the following:

i) A theoretical knowledge of the major subject/s and such additional modules as may be prescribed (Animal science modules on 800-level).
ii) A thesis.

VKU 900 Animal science 900
VKU 990 Thesis: Animal science 990 (360 credits)

Total credits required: 360

9.5 PhD in Consumer Science

a. Admission requirements

MConsumer Science or applicable master's degree with a pass mark of at least 60%.

To proceed with the thesis a student should have fulfilled the requirements for the master's degree regarding the following modules or modules with similar content and scope including publication record:

- Theoretical frameworks;
- Research methodology 814 (NMN 814) or similar module of the same level and scope;
- The student has published at least one article in an accredited/refereed research journal during the two years prior to registration for the PhD degree or can prove that one has been accepted in an accredited/refereed journal.

It must be evident from the master's dissertation or publications based on it, that the candidate is able to undertake research independently.

Note: It may be required from the student to do additional coursework.

b. Degrees, duration of study and number of credits

The following fields of specialisation and degrees are offered:

Interior Merchandise Management	02263001
Clothing Management	02263002
Food Management	02263004
Development	02263003

The programme extends over a minimum of two and a maximum of five years of study.

Total credits required: 360

9.6 PhD in Food Science (Code 03260272)

Programme composition

The degree is awarded based on a thesis and other requirements as follows:

FST 901 Examination: Food science 901 (40 credits)
Oral examination in Food Science and related fields at the doctoral level by nationally and internationally renowned experts.

FST 990 Thesis: Food science 990 (360 credits)
Each candidate must write a thesis on his/her research project in Food Science and have at least a research paper accepted for publication in a peer-reviewed scientific journal.

Total credits required: 400

9.7 PhD in Horticultural Science (Code 03262167)

Programme composition

TBK 900	Horticultural science 900	(60 credits)
TBK 990	Thesis: Horticultural science 990	(300 credits)

Total credits required: 360

9.8 PhD in Nutrition (Code 03261006)

Each candidate must write a thesis on his/her research project in Nutrition and have at least a research paper accepted for publication in a peer-reviewed scientific journal.

Programme composition

VDG 900 Oral examination: Nutrition 900	
VDG 990 Thesis: Nutrition 990	(480 credits)

Total credits required: 480

9.9 PhD in Pasture Science (Code 03262165)

Programme composition

WDE 900	Pasture science 900	(60 credits)
WDE 990	Thesis: Pasture science 990	(300 credits)

Total credits required: 360

9.10 PhD in Soil Science (Code 03262166)

Programme composition

GDK 900	Soil science 900	(60 credits)
GDK 990	Thesis: Soil science	(300 credits)

Total credits required: 360

9.11 PhD in Wildlife Management (Code 03261001)

a. Admission requirements

MSc in Wildlife Management or an equivalent applicable degree.

b. Programme composition

NLB 900	Wildlife management 900	
NLB 990	Thesis: Wildlife management 990	(360 credits)

Research project with thesis only

Total credits required: 360

10. HONOURS PROGRAMMES IN THE MATHEMATICAL SCIENCES

10.1 BScHons in Actuarial Science (Code 02240275)

a. Admission requirements

An appropriate bachelor's degree with an average of 60% for all modules on third-year level, as well as exemption recommendations for at least five of the Core Technical subjects of the Institute/Faculty of Actuaries or the Actuarial Society of South Africa. Details are available from the Head of the Department of Insurance and Actuarial Science as well as from the departmental brochure.

b. Duration of study

A student for an honours degree must complete his or her study, in the case of full-time students, within two years and, in the case of part-time students, within three years of first registering for the degree. Under special circumstances, the Dean, on the recommendation of the head of department, may give approval for a limited extension of this period.

c. Promotion

The progress of all honours candidates is monitored biannually by the head of department. A candidate's study may be terminated if the progress is unsatisfactory or if the candidate is unable to finish his/her studies during the prescribed period.

d. Programme composition

Details of the compilation of the curriculum are available from the head of department as well as from the departmental brochure.

To qualify for this degree, the candidate must successfully complete a total of at least 160 credits, made up from modules from the curriculum in collaboration with, and subject to the approval of the Head of the Department of Insurance and Actuarial Science.

Total credits required: At least 160

10.2 BScHons in Applied Mathematics (Code 02240171)

a. Admission requirements

An appropriate BSc degree with a minimum of 60% for all Mathematics/Applied mathematics modules on third-year level. In the selection procedure the candidate's complete undergraduate academic record will be considered. In particular, it is required that the candidate has completed Real analysis on third-year level as well as one of the modules Partial differential equations, Ordinary differential equations or Numerical analysis on third-year level (each with a mark of at least 60%).

b. Duration

The minimum duration is one year of full-time study or two years of part-time study. A student must complete his or her study for an honours degree, in the case of full-time students, within two years from the first examination to the final examination and in the case of part-time students, within three years from the first examination to the final examination. Under special circumstances, the Dean, on the recommendation of the head of department, may give approval for a limited extension of this period.

c. Promotion

The progress of all honours candidates is monitored biannually by the postgraduate coordinator/head of department. A candidate's study may be terminated if the progress is unsatisfactory or if the candidate is unable to finish his/her studies during the prescribed period.

d. Programme composition

The programme compilation consists of seven honours modules of 20 credits each (six compulsory and one elective) as well as the mandatory essay (20 credits).

Full details of the compilation of the curriculum are available in the departmental postgraduate brochure at: www.up.ac.za/maths/postgrad

To qualify for this degree, the candidate must successfully complete a total of at least 160 credits, made up from modules from the curriculum as approved by the Postgraduate Coordinator/Head of the Department of Mathematics and Applied Mathematics.

Total credits required: 160

10.3 BScHons in Financial Engineering (Code 02240274)

a. Admission requirements

An appropriate bachelor's degree with a minimum of 60% for all modules on third-year level. In the selection procedure the candidate's complete undergraduate academic record will be considered. In particular, it is required that the candidate has completed Calculus, Differential equations and Linear algebra on second-year level (each with a mark of at least 60%).

b. Duration

The minimum duration is one year of full-time study or two years of part-time study. A student must complete his or her study for an honours degree, in the case of full-

time students, within two years from the first examination to the final examination and in the case of part-time students, within three years from the first examination to the final examination. Under special circumstances, the Dean, on the recommendation of the head of department, may give approval for a limited extension of this period.

c. Promotion

The progress of all honours candidates is monitored biannually by the postgraduate coordinator/head of department. A candidate's study may be terminated if the progress is unsatisfactory or if the candidate is unable to finish his/her studies during the prescribed period.

d. Programme composition

The programme compilation consists of a number of compulsory and elective honours modules of 16 – 20 credits each (totalling at least 140 credits), as well as the mandatory project (20 credits).

Full details of the compilation of the curriculum are available in the departmental postgraduate brochure at: www.up.ac.za/maths/postgrad

To qualify for this degree, the candidate must successfully complete a total of at least 160 credits, made up from modules from the curriculum in collaboration with, and subject to the approval of the postgraduate coordinator/Head of the Department of Mathematics and Applied Mathematics.

Total credits required: 160

10.4 BScHons in Mathematical Statistics (Code 02240191)

a. Admission requirements

i) A relevant bachelor's degree with Mathematical Statistics on the 300-level is required.
ii) For BScHons and BComHons in Mathematical Statistics, an average mark of 65% or more
   - in Mathematical statistics on the 300-level or
   - in an equivalent statistical module(s) at an accredited institution is required.
iii) Students from other accredited institutions will be required to pass an entrance examination.
iv) Student numbers are limited to a maximum of 40, collectively over all honours programmes in the Department of Statistics. Selection is based on performance in the prior degree, conditional on ii and iii above.

b. Duration of programme

The minimum duration is one year of full-time study or two years of part-time study. A student must complete his or her study for an honours degree, in the case of full-time students, within two years from the first examination to the final examination and in the case of part-time students, within three years from the first examination to the final examination. Under special circumstances, the Dean, on the recommendation of the head of department, may give approval for a limited extension of this period.

c. Promotion

The progress of all honours candidates is monitored biannually by the postgraduate coordinator/head of department. A candidate's study may be terminated if the progress is unsatisfactory or if the candidate is unable to finish his/her studies during the prescribed period.

d. Programme composition

Details of compilation of curriculum are available from the Head of the Department of Statistics as well as from the departmental postgraduate brochure.
A candidate must compile his/her curriculum in consultation with the head of department or his representative. It is also possible to include postgraduate modules from other departments. Refer to the Departmental website for further information.

Total credits required: At least 160

10.5 BScHons in Mathematics (Code 02240181)

a. Admission requirements

An appropriate BSc degree with a minimum of 60% for all Mathematics/Applied mathematics modules on third-year level. In the selection procedure the candidate's complete undergraduate academic record will be considered. In particular, it is required that the candidate has completed Real analysis and Algebra on third-year level (each with a mark of at least 60%).

b. Duration

The minimum duration is one year of full-time study or two years of part-time study. A student must complete his or her study for an honours degree, in the case of full-time students, within two years from the first examination to the final examination and in the case of part-time students, within three years from the first examination to the final examination. Under special circumstances, the Dean, on the recommendation of the head of department, may give approval for a limited extension of this period.

c. Promotion

The progress of all honours candidates is monitored biannually by the postgraduate coordinator/head of department. A candidate's study may be terminated if the progress is unsatisfactory or if the candidate is unable to finish his/her studies during the prescribed period.

d. Programme composition

The programme compilation consists of seven honours modules of 20 credits each (six compulsory and one elective) as well as the mandatory essay (20 credits).

Full details of the compilation of the curriculum are available in the departmental postgraduate brochure at: www.up.ac.za/maths/postgrad

To qualify for this degree, the candidate must successfully complete a total of at least 160 credits, made up from modules from the curriculum in collaboration with, and subject to the approval of the postgraduate coordinator/Head of the Department of Mathematics and Applied Mathematics.

Total credits required: 160

10.6 BScHons in Mathematics of Finance (Code 02240272)

a. Admission requirements

An appropriate BSc degree with a minimum of 60% for all Mathematics/Applied mathematics modules on third-year level. In the selection procedure the candidate's complete undergraduate academic record will be considered. In particular, it is required that the candidate has completed Real analysis on third-year level and Linear algebra on second-year level (each with a mark of at least 60%).

b. Duration

The minimum duration is one year of full-time study or two years of part-time study. A student must complete his or her study for an honours degree, in the case of full-time students, within two years from the first examination to the final examination and in the case of part-time students, within three years from the first examination to the final examination. Under special circumstances, the Dean, on the recommendation of the head of department, may give approval for a limited extension of this period.

c. Promotion

The progress of all honours candidates is monitored biannually by the postgraduate coordinator/head of department. A candidate's study may be terminated if the progress is unsatisfactory or if the candidate is unable to finish his/her studies during the prescribed period.

d. Programme composition

The programme compilation consists of seven honours modules of 20 credits each (six compulsory and one elective) as well as the mandatory research report or project (20 credits).

Full details of the compilation of the curriculum are available in the departmental postgraduate brochure at: www.up.ac.za/maths/postgrad

To qualify for this degree, the candidate must successfully complete a total of at least 160 credits, made up from modules from the curriculum in collaboration with, and subject to the approval of the postgraduate coordinator/Head of the Department of Mathematics and Applied Mathematics.

Total credits required: 160

11. MASTER'S PROGRAMMES IN THE MATHEMATICAL SCIENCES

11.1 MSc in Actuarial Science (Code 02250395)

Details are available from the Head of the Department of Insurance and Actuarial Science as well as in the departmental brochure.

Total credits required: 240

11.2 MSc in Applied Mathematics (Code 02250171)

a. Admission requirements

An appropriate BScHons degree with a minimum of 60% for all modules at honours level. In the selection procedure the candidate's complete undergraduate and honours academic record will be considered. In particular, it is required that the following modules be included on honours level: Measure and integration theory, Functional analysis, Partial differential equations and Numerical analysis.

Admission is also subject to the availability of a suitable supervisor for the study.

b. Duration

The duration for this degree is two years. Subject to other faculty regulations, a student for a master's degree must complete his or her studies within four years after first registering for the degree. Under special circumstances, the Dean, on the recommendation of the head of department, may give approval for a limited fixed extension of this period. (See Regulations G.32 and G.36.)

c. Promotion

The progress of all master's candidates is monitored biannually by the supervisor and the postgraduate coordinator. A candidate's study may be terminated if the progress is unsatisfactory or if the candidate is unable to finish his/her studies during the prescribed period.

d. Programme composition

The programme compilation consists of three master's modules of 40 credits each (as approved by the postgraduate coordinator) as well as a dissertation (120 credits).Full details of the compilation of the curriculum are available in the departmental postgraduate brochure at: www.up.ac.za/maths/postgrad

Total credits required: 240

11.3 MSc in Applied Statistics (Code 02250401)

a. Admission requirements

i) A relevant honours degree in Mathematical Statistics is required.

ii) For MSc (Applied Statistics) a minimum average mark of 65% or more
- in the BScHons in Mathematical Statistics or
- in an applicable honours degree at an accredited institution is required.

iii) Students from other accredited institutions will be required to pass an entrance examination.

iv) Student numbers are limited to a maximum of 20, collectively over all master's programmes in the Department of Statistics. Selection is based on performance in the prior degree, conditional on ii and iii above.

v) Admission is also subject to the availability of a suitable supervisor for the study.

b. Duration

The duration for this degree is two years. Subject to other faculty regulations, a student for a master's degree must complete his or her studies within four years after first registering for the degree. Under special circumstances, the Dean, on the recommendation of the head of department, may give approval for a limited fixed extension of this period. (See Regulations G.32 and G.36.)

c. Promotion

The progress of all master's candidates is monitored biannually by the supervisor and the postgraduate coordinator. A candidate's study may be terminated if the progress is unsatisfactory or if the candidate is unable to finish his/her studies during the prescribed period.

d. Programme composition

Details of compilation of curriculum are available from the Head of the Department of Statistics as well as from the departmental postgraduate brochure.
A candidate must compile his/her curriculum in consultation with the head of department or his representative. Refer to the Departmental website for further information.

Total credits required: 240

11.4 MSc in Financial Engineering (Code 02250184)

a. Admission requirements

An appropriate BScHons degree in Financial Engineering with a minimum of 60% for all modules at honours level. In the selection procedure the candidate's complete undergraduate and honours academic record will be considered.
Admission is also subject to the availability of a suitable supervisor for the study.

b. Duration

The duration for this degree is two years. Subject to other faculty regulations, a student for a master's degree must complete his or her studies within four years after first registering for the degree. Under special circumstances, the Dean, on the recommendation of the head of department, may give approval for a limited fixed extension of this period. (See Regulations G.32 and G.36.)

c. Promotion

The progress of all master's candidates is monitored biannually by the supervisor and the postgraduate coordinator. A candidate's study may be terminated if the progress is unsatisfactory or if the candidate is unable to finish his/her studies during the prescribed period.

d. Programme composition

The programme compilation consists of three master's modules of 40 credits each (as approved by the postgraduate coordinator) as well as a dissertation (120 credits).

Full details of the compilation of the curriculum are available in the departmental postgraduate brochure at: www.up.ac.za/maths/postgrad

Total credits required: 240

11.5 MSc in Mathematical Statistics (Code 02250191)

a. Admission requirements

i) A relevant honours degree in Mathematical Statistics is required.

ii) For MSc (Mathematical Statistics) a minimum average mark of 65% or more
- in the BScHons in Mathematical Statistics or
- in an applicable honours degree at an accredited institution is required.

iii) Students from other accredited institutions will be required to pass an entrance examination.

iv) Student numbers are limited to a maximum of 20, collectively over all master's programmes in the Department of Statistics. Selection is based on performance in the prior degree, conditional on ii and iii above.

v) Admission is also subject to the availability of a suitable supervisor for the study.

b. Duration

The duration for this degree is two years. Subject to other faculty regulations, a student for a master's degree must complete his or her studies within four years after first registering for the degree. Under special circumstances, the Dean, on the recommendation of the head of department, may give approval for a limited fixed extension of this period. (See Regulations G.32 and G.36.)

c. Promotion

The progress of all master's candidates is monitored biannually by the supervisor and the postgraduate coordinator. A candidate's study may be terminated if the progress is unsatisfactory or if the candidate is unable to finish his/her studies during the prescribed period.

d. Programme composition

Details of compilation of curriculum are available from the Head of the Department of Statistics as well as from the departmental postgraduate brochure.
A candidate must compile his/her curriculum in consultation with the head of department or his representative. Refer to the Departmental website for further information.

Total credits required: 240

11.6 MSc in Mathematics (Code 02250181)

a. Admission requirements

An appropriate BScHons degree with a minimum of 60% for all modules at honours level. In the selection procedure the candidate's complete undergraduate and honours academic record will be considered. In particular, it is required that the following modules be included on honours level: Measure and integration theory, Functional analysis, Topology and Algebra.

Admission is also subject to the availability of a suitable supervisor for the study.

b. Duration

The duration for this degree is two years. Subject to other faculty regulations, a student for a master's degree must complete his or her studies within four years after first registering for the degree. Under special circumstances, the Dean, on the recommendation of the head of department, may give approval for a limited fixed extension of this period. (See Regulations G.32 and G.36.)

c. Promotion

The progress of all master's candidates is monitored biannually by the supervisor and the postgraduate coordinator. A candidate's study may be terminated if the progress is unsatisfactory or if the candidate is unable to finish his/her studies during the prescribed period.

d. Programme composition

The programme compilation consists of three master's modules of 40 credits each (as approved by the postgraduate coordinator) as well as a dissertation (120 credits).

Full details of the compilation of the curriculum are available in the departmental postgraduate brochure at: www.up.ac.za/maths/postgrad

Total credits required: 240

11.7 MSc in Mathematics Education (Code 02250183)

a. Admission requirements

An appropriate BScHons degree with a minimum of 60% for all modules at honours level. In the selection procedure the candidate's complete undergraduate and honours academic record will be considered. In particular, it is required that the following modules be included on honours level: Measure and integration theory and Functional analysis.

Admission is also subject to the availability of a suitable supervisor for the study.

b. Duration

The duration for this degree is two years. Subject to other faculty regulations, a student for a master's degree must complete his or her studies within four years after first registering for the degree. Under special circumstances, the Dean, on the recommendation of the head of department, may give approval for a limited fixed extension of this period. (See Regulations G.32 and G.36.)

c. Promotion

The progress of all master's candidates is monitored biannually by the supervisor and the postgraduate coordinator. A candidate's study may be terminated if the progress is unsatisfactory or if the candidate is unable to finish his/her studies during the prescribed period.

d. Programme composition

The programme compilation consists of three master's modules from the Faculty of Education (totalling 40 credits), two master's modules from the Department of Mathematics and Applied Mathematics (totalling 80 credits) as well as a

dissertation (120 credits). The compilation of the modules should be approved by the postgraduate coordinator.

Full details of the compilation of the curriculum are available in the departmental postgraduate brochure at: www.up.ac.za/maths/postgrad

Total credits required: 240

11.8 MSc in Mathematics of Finance (Code 02250182)

a. Admission requirements

An appropriate BScHons degree with a minimum of 60% for all modules at honours level. In the selection procedure the candidate's complete undergraduate and honours academic record will be considered. In particular, it is required that the following modules be included on honours level: Measure and integration theory, Functional analysis and Financial mathematics/Financial engineering.

Admission is also subject to the availability of a suitable supervisor for the study.

b. Duration

The duration for this degree is normally two years. Subject to other faculty regulations, a student for a master's degree must complete his or her studies within four years after first registering for the degree. Under special circumstances, the Dean, on the recommendation of the head of department, may give approval for a limited fixed extension of this period. (See Regulations G.32 and G.36.)

c. Promotion

The progress of all master's candidates is monitored biannually by the supervisor and the postgraduate coordinator. A candidate's study may be terminated if the progress is unsatisfactory or if the candidate is unable to finish his/her studies during the prescribed period.

d. Programme composition

The programme compilation consists of three master's modules of 40 credits each (as approved by the postgraduate coordinator) as well as a dissertation (120 credits).

Full details of the compilation of the curriculum are available in the departmental postgraduate brochure at: www.up.ac.za/maths/postgrad

Total credits required: 240

12. DOCTORAL PROGRAMMES IN THE MATHEMATICAL SCIENCES

12.1 PhD in Mathematical Sciences (Code 02260761)

a. Admission requirements

An appropriate master's degree is required for admission to doctoral study in mathematics and applied mathematics. The programme composition of the master's degree must have included a heavy research component that led to a

dissertation reflecting originality either in the content or in the presentation. In the selection procedure the candidate's complete honours and master's academic records will be considered. In particular, it is required that the master's degree be obtained with distinction. If a candidate did not pass his/her master's degree with distinction, he/she may submit an application together with a motivation by his/her potential supervisor to the postgraduate coordinator.

Admission is also subject to the availability of a suitable supervisor for the study.

b. Duration

Subject to other faculty regulations, a student for a doctoral degree must complete his or her studies within four years after first registering for the degree. Under special circumstances, the Dean, on the recommendation of the head of department, may give approval for a limited fixed extension of this period. (See Regulations G.47 and G.51.)

c. Promotion

The progress of all doctoral candidates is monitored biannually by the supervisor and the postgraduate coordinator. A candidate's study may be terminated if the progress is unsatisfactory or if the candidate is unable to finish his/her studies during the prescribed period.

d. Programme composition

A candidate must complete a thesis in one of several fields in which research is actively being done in the Department. The research fields and the names of possible supervisors are available from the departmental postgraduate brochure at: www.up.ac.za/maths/postgrad

12.2 PhD in Mathematical Statistics (code 02260611)

a. Admission requirements

i) A relevant Master's degree in Mathematical Statistics or Applied Statistics is required.

ii) For PhD (Mathematical Statistics) and PhD (Applied Statistics) a minimum average mark of 65% or more
- in the MSc (Mathematical Statistics) or MSc (Applied Statistics) or
- in an applicable master's degree at an accredited institution is required.

iii) Students from other accredited institutions will be required to pass an entrance examination.

iv) Student numbers are limited to a maximum of 10, collectively over all doctoral programmes in the Department of Statistics. Selection is based on performance in the prior degree, conditional on ii and iii above.

v) Admission is also subject to the availability of a suitable supervisor for the study.

b. Duration

Subject to other faculty regulations, a student for a doctoral degree must complete his or her studies within four years after first registering for the degree. Under special circumstances, the Dean, on the recommendation of the head of department, may give approval for a limited fixed extension of this period. (See Regulations G.47 and G.51.)

c. Promotion

The progress of all doctoral candidates is monitored biannually by the supervisor and the postgraduate coordinator. A candidate's study may be terminated if the progress is unsatisfactory or if the candidate is unable to finish his/her studies during the prescribed period.

d. Programme composition

A candidate must complete a thesis in one of several fields in Applied Statistics or Mathematical Statistics in which research is actively being done within the Department. Details are available from the Head of Department of Statistics as well as in the departmental brochure. Refer to the Departmental website for further information.

Total credits required: 360

Related doctoral degree described elsewhere in this publication:
PhD in Science and Mathematics Education (Code 02260753) on p 81

Please refer to the Centre for Science, Mathematics and Technology Education in this publication (point 21.2, page 80) and to the postgraduate brochure of the Department of Mathematics and Applied Mathematics at: www.up.ac.za/maths/postgrad

CENTRE FOR ENVIRONMENTAL STUDIES (CFES)
[Environmental Studies programme]

The Centre for Environmental Studies is a graduate school for multidisciplinary training and research focusing on the environment. Training aims to satisfy the need for environmental professionals for implementing current environmental legislation as well as industry-driven environmental management systems. Training of students takes place in two ways:

a) Research-based master's and PhD studies in Environmental Science
b) Coursework master's specialisation options in Environmental Studies

Admission requirements

For the master's level programmes, candidate learners must be in possession of a four-year degree qualification, or equivalent degree status with appropriate subjects as prescribed for each field of specialisation. Final admission is subject to the approval of the Director of the Centre and the head(s) of the respective co-ordinating department(s). Candidates for PhD degrees need to have obtained a master's degree in an appropriate field of expertise. Preference will be given to PhD candidates with publication experience in professional journal(s).

13. SPECIALISATION IN AIR QUALITY MANAGEMENT

Coordinated by the Department of Geography, Geoinformatics and Meteorology.

The extensions to the National Environmental Management Act (NEMA) promulgated after 2005 affect environmental management in South Africa in a profound way. In particular, the Air Quality Act brings South African legislation into line with international trends. The metro councils are charged with the responsibility of implementing the Act at the local level. In addition, companies need appropriate expertise to obtain licenses for their air quality management plans. This focus area serves to provide suitable expertise for the implementation of the above legislation by industry by training graduates specialised for careers in air quality management. On completion of the training, candidates should be conversant and be able to partake in, or render advice concerning the legislative requirements with respect to air quality management, modelling of and measurement of air pollution and the interpretation of pollution plumes, the measurement and interpretation of chemical air pollution as well as dust pollution, international agreements and requirements as well as the effects of air pollution on humans.

13.1 MSc [Option: Air Quality Management] (Coursework) (Code 03251038)

a. Admission requirements

Candidates must be in possession of an appropriate four-year degree, or equivalent degree status which includes mathematics and chemistry at first-year level. Admission is subject to the approval of the Director of the Centre and the appropriate head of department outside the Centre.

b. Programme composition:

Fundamental modules (40 credits):

ENV 810	Environmental paradigms 810	(20 credits)
ENV 816	Environmental law 816	(20 credits)

Core modules (80 credits):

AQM 811	Boundary layer meteorology 811	(20 credits)
AQM 812	Atmospheric chemistry 812	(20 credits)
AQM 813	Atmospheric thermodynamics 813	(20 credits)
AQM 814	Air pollution: Society and environment 814	(20 credits)

Research project (120 credits):

ENV 891	Research project 891	(120 credits)

Total credits required: 240

13.2 PhD [Option: Air Quality Management] (Code 03260129)

Admission is dependent on the candidate being in possession of an MSc [Option: Air Quality Management], or an equivalent degree with the status thereof, as evaluated by the Director of the Centre and the head(s) of the particular department(s). In addition to further theoretical studies as prescribed by the Director and head(s) of the relevant department, the study will involve a doctoral research thesis under guidance of a supervisor selected by the Director and head

of department. The supervisor will be a suitable academic staff member of the University of Pretoria.

ENV 998 Thesis: Air quality management 998 (360 credits)

Total credits required: 360

14. SPECIALISATION IN ENVIRONMENT AND SOCIETY

Coordinated by the Department of Geography, Geoinformatics and Meteorology.

The purpose of this focus area is to train environmental graduates who specialised in careers in the humanities. On completion of the training, candidates should be conversant and be able to partake in, or render advice concerning, all aspects involved in the management of human-environment interactions. This includes social impact assessments, policy formulation, social development and planning, participatory appraisal assessments, demographic pattern and trend interpretations, resource appraisals and management.

14.1 MSc in Environment and Society (Coursework) (Code 03251032)

a. Admission requirements

Before application for admission to the MSc (Environment and Society) degree programme candidates must be in possession of a four-year degree qualification, BScHons, or equivalent degree status which includes appropriate subjects in the humanities, geography or planning. Final admission is subject to the approval of the Director of the Centre and the Head of the Department of Geography, Geoinformatics and Meteorology.

b. Programme composition:

Core modules (40 credits):

ENV 810	Environmental paradigms 810	(20 credits)
ENV 816	Environmental law 816	(20 credits)

Specialisation modules (40 credits):

ENS 811	Environment and development 811	(20 credits)
ENS 822	Strategic environmental management 822	(20 credits)

One module selected from:

ENS 823	Environment and land reform 823	(20 credits)
ENS 824	Social modelling and assessment 824	(20 credits)
OMS 881	Environmental change 881	(20 credits)

Elective module (20 credits):

At least one additional elective module must be selected in consultation with the Director of the Centre and the Head of the Department of Geography, Geoinformatics and Meteorology. Options will be based on the academic background and/or anticipated career of the candidate.

Research project (120 credits):

ENV 891	Research project 891	(120 credits)

Total credits required: 240

14.2 PhD in Environment and Society (Code 03260122)

Admission is dependent on the candidate being in possession of an MSc in Environment and Society, or an equivalent degree with the status thereof, as evaluated by the Director of the Centre and the head(s) of the particular department(s). In addition to further theoretical studies as prescribed by the Director and head(s) of the relevant department(s), the study will involve a doctoral research thesis under guidance of a supervisor selected by the Director and head of department. The supervisor will be a suitable academic staff member of the University of Pretoria.

ENV 991 Thesis: Environment and society 991	(360 credits)

Total credits required: 360

15. SPECIALISATION IN ENVIRONMENTAL ECOLOGY

Coordinated by the Department of Zoology and Entomology.

The purpose of this focus area is to train environmental graduates who specialised in careers in the ecology of the environment, including conservation planning, environmental management and air quality management. On completion of the training, candidates should be conversant and be able to partake in, or render advice concerning, all aspects involved in the management of the ecological consequences of human existence. This includes a thorough grounding in ecosystem structure, composition and function, ecosystem services, notions of ecosystem health, the management of declining and small populations, captive propagation, control of invasive species, species and community restoration, conservation education, local communities and conservation, as well as aspects of biogeography and macro-ecology, conservation planning and monitoring, the structure, composition and function of biological communities, population and community variability.

15.1 MSc in Environmental Ecology (Coursework) (Code 03251033)

a. Admission requirements

Before application for admission to the MSc (Environmental Ecology) degree programme, candidates must be in possession of a four-year degree qualification, BScHons, or equivalent degree status which includes appropriate subjects in ecology. Admission is subject to the approval of the Director of the Centre and the appropriate head of department outside the Centre.

b. Programme composition

Compulsory modules (40 credits):

ENV 810	Environmental paradigms 810	(20 credits)
ENV 816	Environmental law 816	(20 credits)

Elective modules (80 credits):
A minimum of 80 credits must be selected from the elective modules subject to the approval of the Director of the Centre. Choice of electives will be based on the academic background and/or anticipated career of the student. Students studying conservation ecology have to register for Conservation planning and monitoring 808 (ZEN 808) and Conservation in practice 875 (ZEN 875) as electives. (30 credits each)

Research project (120 credits):
ENV 891 Research project 891 (120 credits)

Total credits required: 240

15.2 PhD in Environmental Ecology (Code 03260123)

a. Admission requirements
Admission is dependent on the candidate being in possession of an MSc in Environmental Ecology, or an equivalent degree with the status thereof, as evaluated by the Director of the Centre and the head(s) of the particular department(s). In addition to further theoretical studies as prescribed by the Director and head(s) of the relevant department(s), the study will involve a doctoral research thesis under guidance of a supervisor selected by the Director and head of department. The supervisor will be a suitable academic staff member of the University of Pretoria.

b. Programme composition
ENV 992 Thesis: Environmental ecology 992 (360 credits)

Total credits required: 360

16. SPECIALISATION IN ENVIRONMENTAL ECONOMICS

Coordinated by the Department of Agricultural Economics, Extension and Rural Development

The purpose of this focus area is to train environmental graduates who specialised in careers in environmental economics and policy. On completion of the training, candidates should be conversant and be able to partake in, or render advice concerning, all aspects involved in the economic implications of environmental resource use. This includes economic analytical approaches, economic inefficiency, misallocation, market failure, policy failure, the economics of renewable and non-renewable resources, cost-benefit analysis, valuation of environmental goods and services, environmental accounting, temporal allocation and dynamic optimisation of resource use.

16.1 MSc in Environmental Economics (Coursework) (Code 03251034)

a. Admission requirements
For admission to the MSc in Environmental Economics, candidates must have a four-year degree qualification (BScHons, BScAgric or BScAgric in Agricultural Economics) or equivalent degree status, with appropriate subjects in economics

and statistics. Final admission is subject to the approval of the Director of the Centre of Environmental Economics and Policy (CEEPA) and/or the Head of the Department of Agricultural Economics, Extension and Rural Development.

b. Programme composition

Required modules:

Core modules (95 credits):

LEK 711	Advanced production economics 711	(15 credits)
LEK 780	Introduction to natural resource and environmental economics 780	(15 credits)
LEK 785	Agricultural project planning and appraisal 785	(15 credits)
LEK 712	Agricultural policy analysis 712	(15 credits)
LEK 886	The economics of natural resources 886	(15 credits)
ENV 810	Environmental paradigms 810	(20 credits)

Specialisation modules (75 credits):

MIE 780	Microeconomics 780	(20 credits)
EKT 713	Econometrics 713	(20 credits)
LEK 810	Agricultural economics 810 (Advanced econometrics)	(20 credits)
LEK 814	Agricultural economics: Quantitative models for agricultural policy 814	(15 credits)

Dissertation

LEK 890	Dissertation: Agricultural economics 890	(180 credits)

Total credits required: 350

16.2 PhD in Environmental Economics (Code 03260124)

Admission is dependent on the candidate being in possession of an MSc in Environmental Economics, or an equivalent degree with the status thereof, as evaluated by the Director of the Centre and the head(s) of the particular department(s). In addition to further theoretical studies as prescribed by the Director and head(s) of the relevant department(s), the study will involve a doctoral research thesis under guidance of a supervisor selected by the Director and head of department. The supervisor will be a suitable academic staff member of the University of Pretoria.

Programme composition

ENV 993	Thesis: Environmental economics 993	(360 credits)

Total credits required: 360

17. SPECIALISATION IN ENVIRONMENTAL MANAGEMENT

Coordinated by the Department of Zoology and Entomology.

The purpose of this focus area is to train environmental graduates considered generalists for managing the full spectrum of human-environment-economic interactions. On

completion of the training, candidates should be conversant and be able to partake in, or render advice concerning, all aspects involved in managing social, economic and environmental processes in a sustainable manner. This includes social and environmental impact assessment, policy formulation, social development and planning, eco-system structure, composition and function, ecosystem services, ecosystem health, invasive species, species and community restoration, conservation education, local communities and conservation, economic inefficiency, misallocation, market failure, policy failure, the economics of renewable and non-renewable resources, cost-benefit analysis, valuation of environmental goods and services and environmental accounting.

17.1 MSc [Option: Environmental Management] (Coursework) (Code 03251037)

a. Admission requirements

Candidates must be in possession of a BScHons degree or a degree with equivalent degree status. Final admission is subject to the approval of the Director of the Centre for Environmental Studies.

b. Programme composition

Compulsory core modules (40 credits):

ENV 810	Environmental paradigms 810	(20 credits)
ENV 816	Environmental law 816	(20 credits)

Coursework modules (70 credits):

ZEN 811	Conservation and development 811	(30 credits)
ENS 811	Environment and development 811	(20 credits)
ENS 822	Strategic environmental management 822	(20 credits)

Elective module (20 credits):

At least one additional elective module must be selected in consultation with the Director of the Centre for Environmental Studies and the Director of the Postgraduate School of Agriculture and Rural Development. Options will be based on the academic background and/or anticipated career of the candidate.

Research project (120 credits):

ENV 891	Research project 891	(120 credits)

Total credits required: 250

Also refer to the MInstAgrar in Environmental Management (Coursework) (Code 03252132) on page 97 of this publication

17.2 PhD [Option: Environmental Management] (Code 03260125)

a. Admission requirements

Admission is dependent on the candidate being in possession of an MSc or MInstAgrar in Environmental Management, or an equivalent degree with the status thereof, as evaluated by the Director of the Centre for Environmental Studies, the Director of the Postgraduate School for Agriculture and Rural Development and the head(s) of the particular department(s). In addition to further theoretical studies as

prescribed by the Director and head(s) of the relevant department(s), the study will involve a doctoral research thesis under guidance of a supervisor selected by the Director and head of department. The supervisor will be a suitable academic staff member of the University of Pretoria.

b. Programme composition

ENV 994:	Thesis: Environmental management 994	(360 credits)

Total credits required: 360

18. SPECIALISATION IN ENVIRONMENTAL EDUCATION

Coordinated by the Faculty of Education.

The purpose of this focus area is to train environmental graduates who specialised in careers in environmental education. On completion of the training, candidates should be conversant and be able to partake in, or render advice concerning, all aspects involved in the transfer of environmental principles by education. This includes the transfer of relevant ethical, social and ecological principles to learners, the roles of the NQF and outcomes-based education for approaches towards environmental education, the roles of facilitation, engagement, meta-learning, creative problem solving, cooperative learning and feedback in the learning task.

18.1 MSc in Environmental Education (Coursework) (Code 03251036)

a. Admission requirements

Before application for admission to the MSc (Environmental Education) degree programme, candidates must be in possession of an appropriate four-year degree qualification, BScHons, or equivalent degree status which includes appropriate educational subjects. Final admission is subject to the approval of the Director of the Centre for Environmental Studies and the Director of the Centre for Science, Mathematics and Technology Education.

b. Programme composition

Compulsory core modules (40 credits):

ENV 810	Environmental paradigms 810	(20 credits)
ENV 816	Environmental law 816	(20 credits)

Compulsory specialisation modules (60 credits):

FOE 811	Foundations of environmental education 811	(20 credits)
FOE 821	Teaching and learning strategies 821	(20 credits)
SCE 881	Research methods in science education 881	(20 credits)

Elective module (20 credits):

At least one additional elective module must be selected in consultation with the Director of the Centre and the Director of the Postgraduate School for Agriculture and Rural Development. Choices will be based on the academic background and/or anticipated career of the candidate.

Project (120 credits):

ENV 891	Research project 891	(120 credits)

Total credits required: 240

19. SPECIALISATION IN FOREST MANAGEMENT AND THE ENVIRONMENT

Coordinated by the Department of Plant Production and Soil Science.

The purpose of this option is to equip graduates with a biological and/or agricultural background to specialise further to obtain skills in environmental management and in sustainable forest resource use and management. On completion of the training, candidates should be conversant with the multifunctional nature of the forest resource base and be equipped to render advice concerning forest resource use and management with an understanding of the environmental consequences associated with exploitative use of natural resources. This includes grounding in forest resource use and management, including yield regulations in natural and commercial forest systems, participatory approaches to natural resource management, ecosystem structure, composition and function, ecosystem services, notions of ecosystem health, control of invasive species and community restoration, understanding of local communities, forestry and rural development, participatory planning and monitoring, the forest harvesting schedules and logistics, non-timber forest products, the science of wood and forest wood products utilisation, understanding of the basic economics of natural resources and social development and planning.

19.1 MSc [Option: Forest Management and the Environment](Coursework) (Code 03251039)

a. Admission requirements

Candidates must have either a three-year BSc and a BScHons, or a four-year degree qualification in agricultural, forestry, or biological sciences. Admission is subject to the approval of the Forestry Chair in consultation with the Director of the Centre for Environmental Studies.

b. Programme composition:

Core modules (60 credits):

ENV 810	Environmental paradigms 810	(20 credits)
ENV 816	Environmental law 816	(20 credits)
FOR 831	General introduction to forestry 831	(20 credits)

Specialisation modules (20 – 60 credits):

1) Choose <u>at least one</u> module from the following:

LEK 831	Forest resource economics and policy 831	(20 credits)
FOR 832	Forest resource use planning and management 832	(20 credits)
FOR 833	Forest engineering 833	(20 credits)
FOR 834	Wood science and forest products 834	(20 credits)
ENV 833	Trees in a multifunctional landscape 833	(20 credits)
FOR 835	Forest ecology and management 835	(20 credits)
FOR 836	Silviculture 836	(20 credits)

2) Choose elective modules to a maximum of 40 credits out of a total of 140 taught module credits from the following:

ENS 822	Strategic environmental management 822	(20 credits)
ENS 823	Environment and land reform 823	(20 credits)
ENV 822	International environmental management systems 822	(20 credits)
OMS 881	Environmental change 881	(20 credits)

Project (120 credits):

ENV 891	Research project 891	(120 credits)

Total credits required: 240

20. SPECIALISATION IN WATER RESOURCE MANAGEMENT

Coordinated by the Department of Microbiology and Plant Pathology

The purpose of this focus area is to train environmental graduates who specialised in careers in the sustainable management of water resources. On completion of the training, candidates should be conversant and be able to partake in, or render advice concerning, all aspects involved in water resource management in Southern Africa. This includes principles of quality management, water conservation, water demand management, water supply and sanitation technologies.

20.1 MSc in Water Resource Management (Coursework) (Code 03251035)

a. Admission requirements

Before application for admission to the MSc (Water Resource Management) degree programme, candidates must be in possession of a four-year degree qualification, BScHons, or equivalent degree status which includes appropriate subjects in water management and/or water ecology. Final admission is subject to the approval of the Director of the Centre for Environmental Studies and the Head of the Department of Microbiology and Plant Pathology.

b. Programme composition

Compulsory core modules (40 credits):

ENV 810	Environmental paradigms 810	(20 credits)
ENV 816	Environmental law 816	(20 credits)

Compulsory specialisation modules (60 credits):

EWM 810	Water quality management 810	(20 credits)
EWM 821	Water conservation and demand management 821	(20 credits)
EWM 822	Water supply and sanitation 822	(20 credits)

Elective module (20 credits):
At least one additional elective module must be selected in consultation with the Director of the Centre and the Head of the Department of Microbiology and Plant Pathology. Choice of electives will be based on the academic background and/or anticipated career of the candidate.

Project (120 credits):

ENV 891	Research project 891	(120 credits)

Total credits required: 240

20.2 PhD in Water Resource Management (Code 03260126)

a. Admission requirements

Admission is dependent on the candidate being in possession of an MSc in Water Resource Management, or an equivalent degree with the status thereof, as evaluated by the Director of the Centre for Environmental Studies and the head(s) of the particular department(s). In addition to further theoretical studies as prescribed by the Director and head(s) of the relevant department(s), the study will involve a doctoral research thesis under guidance of a supervisor selected by the Director and head of department. The supervisor will be a suitable academic staff member of the University of Pretoria.

b. Programme composition

ENV 990 Thesis: Water resource management 990 (360 credits)

Total credits required: 360

Additional possible electives in Environmental studies:
Any module at master's level in either diplomatic studies or political policy studies as approved by the Head of the Department of Political Sciences and the Director of the Centre for Environmental Studies.

21. CENTRE FOR SCIENCE, MATHEMATICS AND TECHNOLOGY EDUCATION

21.1 MSc in Science Education (Code 02250442)

Students are registered in a discipline department. The MSc (Science Education) is designed for educators who wish to pursue their postgraduate studies in both a scientific discipline and in science education. Science, in this context, is interpreted in its broadest sense, and includes the physical, biological and earth sciences, as well as mathematics and technology.

At the end of this programme the student will be capable of doing research in both scientific and educational disciplines. Candidates achieve an adequate background to pursue further qualifications in either content disciplines or the discipline of Science Education.

a. Admission requirements

Refer to regulation Sc 11.1 in the Regulations: Faculty of Natural and Agricultural Sciences (Undergraduate).

b. Programme composition

Modules to a maximum of 60 credits may be required by the head of the department concerned. The dissertation will be supervised jointly by the Centre for Science Education and a discipline department.

Where a candidate wishes to register for the MSc programme without a prior BScHons, additional postgraduate coursework (additional to the required 240 credits) is compulsory. Refer to regulation Sc 11.1 (b) of the Regulations: Faculty of Natural and Agricultural Sciences (Undergraduate).

Total credits required: 240

Related master's degrees described elsewhere in this publication:

MSc in Mathematics Education (Code 02250183) on page 67
MSc in Environmental Education (Code 03251036) on page 77

21.2 PhD in Science and Mathematics Education (Code 02260753)

The programme is designed for science educators at all levels who wish to pursue their postgraduate studies in science education but closely allied with a scientific discipline. Science, in this context, is interpreted in its broadest sense, and includes the physical, biological and earth sciences, as well as mathematics and technology.

At the end of this programme the student will be capable of doing independent research within the values and approaches of the sciences, and their impact and role in the broader social and economic environment with an educational focus.

For admission to the PhD in Science and Mathematics Education, the programme composition of the master's degree must have included a reasonable research component that led to a dissertation.

a. Admission requirements

The status of a master's degree, subject to regulation Sc.12 of the Regulations: Faculty of Natural and Agricultural Sciences (Undergraduate).

A candidate must demonstrate expertise in education research methodology (including relevant statistical methods) and in current thinking in the field, with the understanding that a candidate who does not satisfy the required level of expertise may be admitted on condition that additional agreed study assignments are completed and/or examinations passed.

b. Programme composition

For science education, the code for the PhD thesis is SCE 990 (Thesis: Science education 990) (360 credits).

For mathematics education, consult the Department of Mathematics and Applied Mathematics. The code for the PhD thesis is WTW 993 (Thesis: Mathematics education 993) (360 credits).

Total credits required: 360

Refer to regulation Sc. 12 of the Regulations: Faculty of Natural and Agricultural Sciences (Undergraduate) as well as General Regulations G.45 to G.61 of the University.

OTHER MODULES

A head of department may determine that the language proficiency module: **Advanced academic literacy 300** (EOT 300) must be prescribed under certain conditions. In such an event, this module does not form part of the curriculum of a degree programme. This is applicable to all postgraduate students.

Module code	Department	Credits	Full-time	Flexi learning	Language
EOT 300	Unit for Academic Literacy	12	2 lpw	Limited contact	Eng

PROCEDURES AND POLICIES CONCERNING POSTGRADUATE STUDENT TRAINING

AGREEMENT TO BE ENTERED INTO WITH STUDENTS ON REGISTRATION (MOU)

The following provisions should be adhered to:

1. The student will be supplied with the University of Pretoria's Code of Research Ethics and will be required to agree to abide by this code.

2. Agreement on ownership of data and intellectual property rights needs to be clarified with the supervisor before application. The University of Pretoria's policy with regard to Intellectual Property Rights applies (see General Reg. G.57.4).

3. Agreement on authorship of publications. This needs to be clearly defined with the supervisor and the head of department (see General Reg. G.57.4).

See General Regulations G.32.4 and G.33 governing responsibilities and obligations of staff, the Faculty of Natural and Agricultural Sciences' Staff Policy and in particular the University of Pretoria's "Code of Research Ethics".

Supervision
See General Regulation G.57 governing the nomination of supervisors and co-supervisors and the University of Pretoria's "Code of Research Ethics".

Appointment of a supervisor for a student
A prospective postgraduate student should have discussions with a potential supervisor regarding the work that is to be undertaken. Once the supervisor and the student have agreed on a project, the student should be registered and the supervisor appointed. The student and the supervisor should agree to conduct their relationship in accordance with the guidelines given in item: *Agreement to be entered into with students on registration*, above.

The supervisor and/or the head of department may recommend the appointment of a co-supervisor for a particular candidate and project. This will be approved in terms of faculty procedures.

ADDITIONAL FACULTY SUPERVISORY REQUIREMENTS

Supervisory committees
In many/most instances the supervisor and co-supervisor categories are adequate. However, a Supervisory Committee may be useful in cases where multidisciplinary thesis research (especially at PhD level) is undertaken. Such a committee could comprise the supervisor (and co-supervisor if applicable) and an additional two to three members selected for their expertise in specific areas. At least one member of the committee should be outside the department in which the student is registered. The composition of the committee would be approved by the head of department and the Postgraduate Studies Committee. The Supervisory Committee would bear primary responsibility for guiding and monitoring the student's progress until graduation (as is the case of a conventional supervisor/co-supervisor postgraduate degree). Moreover, when appropriate, it is the responsibility of the supervisor or the chairperson of the Supervisory

Committee to recommend that the student be placed on academic probation or be dismissed from the postgraduate programme.

Research proposal
A written research proposal is a prerequisite for all research-based master's and PhD studies. This should be in a format specified by the appropriate department, have been seen and approved by the supervisor (and co-supervisor/Supervisory Committee if applicable), and should be placed in the student's permanent file in the department. The research proposal should include Specific aims, Background and significance, Research design and methods and references as described below:

1. Specific aims:
   State concisely what the research is intended to accomplish and/or what hypothesis is to be tested.

2. Background and significance:
   Briefly sketch the background to the proposal, critically evaluate existing knowledge, and specifically identify what the research will achieve.

3. Research design and methods:
   Briefly summarise how the problem is to be addressed and the procedures that will be used to solve the problem.

Once a draft of the research proposal has been prepared, an oral presentation of the material should be given in the department. The oral presentation should take place within 6 months of initial registration. After this, the final project proposal should be submitted to the supervisor for approval and submission to the Student Administration of the Faculty.

All research protocols that deal with animals, genetically modified organisms, environmental impact and human subjects **must** have the approval of the Ethics Committee. Submission procedures can be obtained from the faculty's web page.

Student progress
The student should meet with the supervisor (and co-supervisor, or committee – whichever is appropriate) at least once each semester to review and critically evaluate the student's research progress to plan future work, and to establish performance criteria and to monitor timetables for the completion of the degree requirements. At six-monthly intervals the student should write a report that is approved by the supervisor and this should be kept on file in the office of the department concerned. The report should contain the following information:

Progress:
1. Research accomplishments of the student and specific recommendations for future research.
2. Modules the student has completed during the past semester.
3. The schedule for completion of degree requirements.

Evaluation:
1. An evaluation of the candidate's research performance.

2. A summary of the student's current strengths and weaknesses (as a developing independent investigator) including comments on written and oral skills.

In addition to the six-monthly evaluation reports, students will be required to submit an annual written progress report. In addition to detailing the incremental progress, the report could include information on publications, awards received, conference participation, courses passed and other related outputs.

Funding and research facilities for undertaking the research project
Both the funding of and facilities required for the study should be identified before the student starts the study. The supervisor bears the primary responsibility for ensuring that the infrastructure and support is in place before the study begins. The head of department should be satisfied that adequate provision has been made for the study before approving the registration of the student.

Approval of the title
The final title of a mini-dissertation/dissertation/thesis should be submitted to the Faculty Student Administration six (6) months before the mini-dissertation/dissertation/thesis is handed in for examination. The title should be recommended by the supervisor and approved in terms of the faculty structures.

Appointment of examiner
This is handled in accordance with the General Regulations by the Dean's office in conjunction with the head of department. The student may not be informed of the names of the external examiners until the process of examination has been completed.

Submission of mini-dissertation/dissertation/thesis
Students need to inform the Faculty Student Administration, three months before the date of proposed submission, of their intention to do so. Students who wish to graduate at a particular graduation ceremony should enquire from the Faculty Student Administration what the dates for submission and completion of the examination process are. These dates are usually significantly in advance of the date of graduation.

The student will submit the mini-dissertation/dissertation/thesis to the Faculty Student Administration Office together with a form signed by the supervisor and if applicable, the co-supervisor that indicates that the material is being submitted with the approval of the supervisor. If a student wishes to submit without the approval of the supervisor, then this must be done through the head of department who should be aware of the circumstances surrounding the submission. If a head of department is the supervisor, the matter will be referred to the Dean.

Termination of registration
Supervisors have the right to recommend termination of the registration of students who fail to maintain satisfactory academic progress in any phase of their postgraduate programme. Students must take special notice of the conditions governing postgraduate study as published in the General Regulations of the University of Pretoria.

In cases of conflict, the supervisor (co-supervisor and Supervisory Committee as applicable) should notify the student in writing (via the head of department) of his/her concern about the student's performance. The student will be placed on probation for one semester and will be given written instructions of the conditions that need to be fulfilled in order to achieve a satisfactory performance. A student who fails to meet the provisions of

the warning, following the probationary period, can be considered for termination of registration by the Postgraduate Studies Committee of the Faculty.

In cases where termination is recommended, the student has the right to appeal to the Dean. The student must make his/her case in writing and a written response should be solicited from the supervisor. It is suggested that the Dean should base hisjudgement on written submissions only but may, where necessary, call for oral responses to questions raised. The Dean's decision is final.

FACULTY GUIDELINES FOR CONSIDERATION OF BTECH AND/OR MTECH STUDENTS TO POSTGRADUATE STUDY

Candidates who hold BTech and/or MTech degrees are required to fulfill the following conditions:

1. Honours level

The candidate must have a BTech degree with a minimum of 60% in the broad area of specialisation that the candidate wishes to pursue for an honours programme. The student will be given conditional acceptance to an honours programme, but in order to align the student's undergraduate training with the outcomes expected of a BSc graduate, the student will be expected to undertake additional coursework at level 6. The head of department concerned will be required to identify specific modules. The programme of study must be recommended by the Postgraduate Studies Committee, Faculty Board and for approval by the Subcommittee of the Senate. Confirmation of candidature will be based on the successful completion of the additional module requirements during the first year of the honours programme.

1.1 Procedure

The candidate must submit an official application form, together with a motivation, matriculation certificate, academic record and a short CV. The CV should include details of relevant work experience and, where applicable, any publications.
The head of department has to identify and prescribe modules as set out in 1 above.
The application is submitted via the Faculty Postgraduate Studies Committee and the Faculty Board, to the Subcommittee of the Senate for approval.
See the guidelines of the Senate of the University of Pretoria as set out below.

2. Master's level

The candidate must have a BTech degree with a minimum of 60% in the broad area of specialisation that he/she wishes to pursue for a master's programme. The student will be given conditional acceptance to a master's programme, but in order to align the student's undergraduate training with the outcomes expected of a BScHons graduate, the student will be expected to undertake additional coursework at levels 6 and 7. Additional coursework will be prescribed by the head of department concerned. A minimum of 70 credits at level 7 will be required. The programme of study must be recommended by the Faculty Postgraduate Studies Committee, Faculty Board and for approval by the Subcommittee of the Senate. Confirmation of candidature will be based on the successfully completion of the additional module requirements during the first year of the master's programme.

2.1 Procedure

The candidate must submit an official application form, together with a motivation, matriculation certificate, academic record and a short CV. The CV should include details of relevant work experience and, where applicable, any publications.
The head of department has to identify and prescribe modules as set out in 1, above.
The application is submitted via the Faculty Postgraduate Studies Committee and the Faculty Board, to the Subcommittee of the Senate for approval.
See the guidelines of the Senate of the University of Pretoria as set out below.

3. Doctoral level

The candidate must have an MTech degree and have obtained at least 60% for the MTech dissertation. Since the PhD is clearly more demanding of a wider (philosophical) scientific background, the selection of candidates for the PhD degree must be stringent, and could include outside evaluation of the dissertation work by nominees selected by the head of department and recommended by the Faculty Postgraduate Studies Committee, evidence of peer-reviewed publication, appropriate work-related experience (i.e. in a research environment) and, where necessary, formal coursework to address deficiencies in the academic background.

3.1 Procedure

The candidate must submit an official application form, together with a motivation, academic record, a copy of the MTech dissertation and a short CV. The CV should include details of appropriate work experience and list of any publications. The head of department will submit a motivation to support the application. The application is submitted, via the Faculty Postgraduate Studies Committee and the Faculty Board, to the Subcommittee of the Senate for approval.
See the guidelines of the Senate of the University of Pretoria as set out below.

SENATE OF THE UNIVERSITY OF PRETORIA GUIDELINES FOR SENATE DISCRETIONARY ADMISSIONS

Regulation G.62 provides as follows:
"G.62 In accordance with section 32 of the Higher Education Act, 1997 (Act No. 101 of 1997) the Senate may:

(a) grant a graduate of another university (either in the Republic or elsewhere) a status at the University that is equivalent to the status the student has at such other university.

(b) admit a person, who
  (i) has passed examinations at another university or institution (either in the Republic or elsewhere) which the Senate deems equivalent to, or higher than the examinations prescribed for a degree at the University, which are set as a prerequisite for admission to a particular postgraduate study programme, or for the admission of such a person as a research student; or
  (ii) in another manner has reached a standard of competence the Senate considers adequate for the purposes of postgraduate study or research at the University, as a student for a postgraduate degree,diploma or certificate".

The regulation provides two alternative routes with regard to the admission of students at postgraduate level in cases where they do not comply with the prescribed requirements:

1. A first possibility is via the academic route where a student has proven himself/ herself on the basis of academic achievement.

2. The second possibility refers to a standard of competence that would make a student eligible to continue with postgraduate studies.

With regard to the viewpoint set out above candidates may, inter alia, be evaluated according to the following criteria:

Honours studies

1. In cases where only a diploma and not a degree programme was previously offered in a certain field of study, the Dean may, in consultation with the head of the department, consider the admission of such candidates.
2. Should a student have the necessary academic background, but did not graduate in the applicable field of study, he/she may be admitted to the honours degree on the grounds of:
   - the successful completion of an oral/written entrance examination; and
   - a submission to the Senate

   In certain cases one or more external examiners may evaluate such an application.

   or
3. The academic merit of a student who has achieved a standard of competence in another manner can be evaluated by means of:
   - a written motivation by the student which is evaluated by the head of the department;
   - the successful completion of an oral/written entrance examination in which one or more external examiners were involved; and
   - a submission to the Senate.

Master's studies

1. The application of a student who is not in possession of the required honours degree which would admit him/her to study for the master's degree, but has an academically advanced background, may be considered on grounds of:
   - the successful completion of an oral/written entrance examination in which one or more external examiners were involved; and
   - a submission to the Senate.

   or
2. In cases where a standard of competence was reached in another manner, status may be granted by means of:
   - a written motivation by the student which was compiled in conjunction with the head of the department and/or study supervisor, and a recommendation;
   - the successful completion of an oral/written entrance examination in which one or more external examiners were involved; and
   - a submission to the Senate.

Doctoral studies

1. The application of a student who is not in possession of the required master's degree which would admit him/her to doctoral study, but has an academically advanced background, may be considered on the grounds of:

- the successful completion of an oral/written entrance examination in which one or more external examiners were involved; and
- a submission to the Senate

or

2. In cases where a standard of competence was reached in another manner, status may be granted by means of:
   - a written submission compiled in conjunction with the head of the department and/or study supervisor in which the standard of competence is indicated;
   - a report by an external reference(s) motivating the merits of admission to doctoral study;
   - the successful completion of an oral/written entrance examination in which one or more external examiners were involved; and
   - a submission to the Senate.

POSTGRADUATE SCHOOL OF AGRICULTURE AND RURAL DEVELOPMENT

INFORMATION AND REGULATIONS FOR 2012

MISSION STATEMENT

To contribute to agricultural and rural development through excellence in teaching and learning, research and community engagement.

1. Background

The Postgraduate School of Agriculture and Rural Development was founded in 1991 to address the need for capacity building through teaching, research and community engagement in agricultural and rural development. The School is one of the largest postgraduate facilities in agriculture and rural development education in Southern Africa. Although most of the students enrolled for the School's academic programmes are from Africa, an increasing number of students from other continents enrol for postgraduate studies in the School. The School's graduates are employed in various international and local development agencies, private sector (co-operatives, banks, consultancy firms and agribusiness), higher education institutions (universities and agricultural colleges), public sector (government departments) and community-based organisations.

2. Mission and objectives

The School aims to contribute to agricultural and rural development through excellence in teaching and learning, research and community engagement.

The objectives of the School are to:

- provide teaching and learning, conduct interdisciplinary research, and implement community engagement programmes in the fields of agricultural and rural development;
- facilitate coordination in the presentation of programmes relating to agriculture and rural development to ensure efficiency and effectiveness;
- support policy formulation and implementation, governance and capacity building within the context of agricultural and rural development;
- broaden access to the services of the University of Pretoria to the wider community by implementing community engagement programmes and provision of short courses;
- prepare students for leadership and management roles in agriculture and rural development; and
- maintain and/or establish partnerships with national, regional and international organisations in agriculture and rural development.

3. Degrees

The following degrees are coordinated in the School:

Bachelor of Agricultural Management Honours [BInstAgrarHons]
Master of Agricultural Management [MInstAgrar]
Doctor of Philosophy [PhD]

3.1 Bachelor of Agricultural Management Honours [BInstAgrarHons]

a. Admission

In order to be accepted for the BInstAgrarHons studies, a candidate must be in possession of an acceptable bachelor's degree. An average of 60% is required for admission. An entrance examination is necessary, although exemption may be granted under certain circumstances, as determined by the Director of the School. Specified ancillary modules, in addition to the honours modules, may be required, as determined by the Director of the School in consultation with the head of department(s) in the candidate's proposed field of specialisation.

b. Fields of specialisation

The BInstAgrarHons degree is awarded in the following fields of specialisation:

- Agricultural Economics, Agribusiness Management, Agricultural Extension
- Land Development, Plant Production (majoring in Agronomy, Horticultural Science or Pasture Science)
- Crop Protection
- Plant Quarantine
- Rural Development Planning

Certain combinations of the above fields are also possible.

c. The coursework extends over a minimum of two semesters.

d. The curriculum consists of a minimum of 160 credits consisting of the following:

- A common core of two modules namely ARD 780 and ARD 782 that must be attended for all fields of specialisation, except in the case of the Extension major, where ARD 782 will be compulsory and ARD 781 can be taken in place of ARD 780. Recognition of equivalent modules already passed may be considered, in which case suitable alternative modules will be prescribed.
- Elective coursework that may be required, will be decided upon by the Director of the School and head(s) of the particular department(s).
- Additional required modules as prescribed for the specific fields of specialisation, will be jointly determined by the Director of the School and the head(s) of the particular department(s) in question.

e. In order to obtain the degree, the candidate must achieve a minimum of 50% in each of the prescribed modules. An average of 75% in all the prescribed modules must be obtained in order to pass the degree with distinction.

3.2 Master of Agricultural Management [MInstAgrar]

a. Admission

Admission to the master's degree is dependent upon the candidate being in possession of the BInstAgrarHons degree of the University of Pretoria, or another appropriate degree equivalent to or higher than the status thereof, as evaluated by the Director of the School and the head(s) of the particular department(s).

b. Fields of specialisation

The same fields of specialisation apply as for the BInstAgrarHons.

c. The curriculum consists of further study in the field of specialisation and a dissertation or, alternatively a script accompanied by more coursework than that required if the dissertation option is followed. The script or mini-dissertation will consist of research done by the candidate under supervision of a member of the Faculty staff. (A dissertation comprises at least 120 of the credits required for the degree, whereas a mini-dissertation comprises 100 credits.)

3.3 Doctor of Philosophy [PhD]

a. Admission
Admission is dependent upon the candidate being in possession of the MInstAgrar degree, or an equivalent appropriate degree with the status thereof, as evaluated by the Director of the School and the head(s) of the particular department(s).

b. Fields of specialisation
The same fields of specialisation apply as for the MInstAgrar.

c. In addition to further theoretical studies as prescribed by the Director and head(s) of the relevant department(s), the study will involve a doctoral research thesis under guidance of a supervisor selected by the Director and head of department. The supervisor will be a member of the Faculty staff.

4. Guidelines for acceptance of BTech/MTech students to postgraduate study

Please see page 83 of this publication.

5. Advanced University Diploma in Extension and Rural Development (Code 03120200)

This diploma is offered on a full-time basis only.

Co-ordinated in the Department of Agricultural Economics, Extension and Rural Development.

a. Admission
In order to be accepted for the Advanced University Diploma in Extension and Rural Development, a candidate must be in possession of

- an appropriate initial university diploma in one of the Agricultural or other appropriate disciplines and have one year relevant extension experience, or
- an appropriate BTech degree or National Diploma plus one year of relevant extension experience, or
- an appropriate Agricultural Diploma or diploma of similar value plus five years of relevant extension experience, or
- a qualification deemed appropriate by the Senate of the University plus approved extension experience (RPL).
- The coursework extends over a minimum of one year. As all modules are not offered at every training venue, it is important to consult the Head of the Department when planning an application.
- The curriculum consists of the following six modules, each worth 20 credits: AGV 412, 413, 415, 426, 428 and 429. Recognition of equivalent modules passed may be considered, in which case suitable alternative modules will be prescribed.

The aim of the extension and rural development programme is to produce diplomats qualified to operate as professional extension and development agents. On completion of the Advanced University Diploma the candidate will be able to design, develop and execute scientifically sound situation-specific and community adapted

extension of development programmes, conforming to the principles of participatory development with maximum community involvement and impact.

To enable them to do this they should:

- be aware and knowledgeable of the philosophies and the different concepts and approaches of development and extension as well as its organisation and management;
- have an understanding of the principles of human behaviour with specific reference to decision-making and behaviour change and the theories involved in understanding and facilitating change;
- be knowledgeable of the theory and practical implementation of community development, group dynamics and leadership for the formulation and execution of development plans;
- have an understanding of the principles of communication and be skilful in the identification and use of the most appropriate communication methods and combination thereof;
- be knowledgeable and skilful in the development, execution and evaluation of situation-specific extension programmes.

b. Programme composition:

AGV 412	Leadership group dynamics 412	(20 credits)
AGV 413	Communication for sustainable rural development 413	(20 credits)
AGV 415	Principles and approaches of rural development and extension 415	(20 credits)
AGV 426	Extension project planning and management 426	(20 credits)
AGV 428	Extension projects evaluation 428	(20 credits)
AGV 429	Human and organisational behaviour change and management 429	(20 credits)

Total credits required: 120 credits

Prospective students are referred to the General Regulations of the University of Pretoria as well as to the Regulations of the Faculty of Natural and Agricultural Sciences.

Further enquiries regarding admission, class fees, accommodation and bursaries may be obtained from:

The Director
Postgraduate School of Agriculture and Rural Development
Faculty of Natural and Agricultural Sciences
University of Pretoria
PRETORIA
0002
Tel:+27 (0)12 420 3280 Fax:+27 (0)12 420 3206
email: PGSARD@up.ac.za

6. Programmes in different fields of specialisation

Please note: All programmes are offered on a full-time basis only

6.1 AGRICULTURAL ECONOMICS

Coordinated in the Department of Agricultural Economics, Extension and Rural Development.

6.1.1 BInstAgrarHons in Agricultural Economics (Code 03242021)

The purpose of this training is to prepare candidates for careers in the economics and management of agriculture and rural development. On completion of the training the candidate should be conversant with and able to partake in, or render advice concerning all aspects involved in management of agriculture and rural development. These aspects involve **at least** the following:

- Agribusiness management
- Production economics
- Marketing of agricultural products and marketing services
- Agricultural policy
- Rural organisations and infrastructure
- Agriculture and rural development
- Project management and analyses
- Resources economics

The graduate should be able to integrate knowledge from different areas into operational systems. The emphasis is on improvement of human welfare. Eventually, the candidate should be able to identify problems and opportunities, analyse these and make appropriate decisions; the intention with this training is to provide to society system-directed problem solvers and opportunity selectors. In this manner, it is hoped to provide useful leaders to society and attractive, challenging careers to graduates.

Programme composition:

ARD 780	Rural development studies 780	(40 credits)
ARD 782	Physical-biological resources and development 782	(20 credits)
LEK 725	Quantitative methods for agricultural economics 725	(20 credits)
LEK 713	Agricultural marketing 713	(15 credits)
LEK 723	Issues in agricultural and applied economics 723	(15 credits)
LEK 702	Introduction to agribusiness management 702	(20 credits)
LEK 785	Agricultural project planning and appraisal 785	(15 credits)

Total credits required: 145

6.1.2 BInstAgrarHons in Agribusiness Management (Code 03242024)

Programme composition:

ARD 780	Rural development studies 780	(40 credits)
LEK 720	Agribusiness management 720	(15 credits)
LEK 702	Introduction to agribusiness management 702	(20 credits)
LEK 713	Agricultural marketing 713	(15 credits)
AGV 713	Communication for sustainable rural development 713	(20 credits)
LEK 722	Agricultural finance and risk management 722	(15 credits)
LEK 782	International agricultural trade and policy 782	(15 credits)

or

LEK 785	Agricultural project planning and appraisal 785	(15 credits)

Total credits required: 140

6.1.3 MInstAgrar in Agricultural Economics (Code 03252021)

The degree can only be taken as a coursework option. The candidate is required to pass at least 80 coursework credits. In addition a mini-dissertation (100 credits) must be submitted under the guidance of a member of the academic staff for a total of 180 credits.

The schedule below indicates modules required for the MInstAgrar degree in Agricultural Economics.

Programme composition:

LEK 780	Introduction to natural resource and environmental economics 780	(15 credits)
LEK 712	Agricultural policy analysis 712	(15 credits)
LEK 784	Advanced rural finance 784	(15 credits)
LOB 800	Rural developmental management 800	(20 credits)
LEK 891	Mini-dissertation 891	(100 credits)

Total credits required: 165

6.1.4 PhD in Agricultural Economics (Code 03260042)

Candidates who followed the MInstAgrar programme can be admitted to the PhD programme in agricultural economics.The details of this programme are presented on page 60.

6.2 ANIMAL PRODUCTION MANAGEMENT

Coordinated in the Department of Animal and Wildlife Sciences.

6.2.1 MInstAgrar in Animal Production Management (Code 03252093)

The programme consists of advanced studies (APZ 801) and a dissertation (APZ 802) on an appropriate research topic in the field of animal production management.

Total credits required: 240

6.2.2 PhD in Animal Production Management (Code 02260545)

Programme composition:

APZ 900	Animal production 900	
APZ 990	Thesis: Animal production 990	(360 credits)

Total credits required: 360

6.3 EXTENSION

Coordinated in the Department of Agricultural Economics, Extension and Rural Development.

6.3.1 BInstAgrarHons in Extension (Code 03242011)

The aim of this degree programme is to produce graduates qualified to operate as professional extension or development agents. On completion of the degree the candidate will be able to design, develop and execute or manage scientifically sound situation-specific and community adapted extension or development programmes, conforming to the principles of participatory development with maximum community involvement and impact.

To enable them to do this they should:

- be aware and knowledgeable of the philosophies and the different concepts and approaches of development and extension as well as its organisation and management;
- have an understanding of the principles of human behaviour with specific reference to decision making and behaviour change and the theories involved in understanding and facilitating change;
- be knowledgeable of the theory and practical implementation of community development, group dynamics and leadership for the formulation and execution of development plans;
- have an understanding of the principles of communication and be skilful in the identification and use of the most appropriate communication methods and combinations thereof;
- be knowledgeable and skilled in the development, execution and evaluation of situation-specific extension programmes.

Programme composition:

Compulsory modules:

ARD 780	Rural development studies 780	(40 credits)
AGV 712	Leadership and group dynamics 712	(20 credits)
AGV 713	Communication for sustainable rural development 713	(20 credits)
AGV 715	Principles and approaches of rural development and extension 715	(20 credits)
AGV 726	Extension programme planning and management 726	(20 credits)
AGV 729	Human and organisational behaviour change and management 729	(20 credits)
LEK 702	Introduction to agribusiness management 702	(20 credits)

Elective modules:

At least one of the following modules:

AGV 728	Extension programme evaluation 728	(20 credits)
LOB 800	Rural developmental management 800	(20 credits)

Total credits required for BInstAgrarHons: 180 credits

A module in Agricultural economics or any other field of specialisation may be included as an elective module, in consultation with the Director of the School and the head(s) of department(s).

6.3.2 MInstAgrar in Extension (Code 03252011)

The degree programme comprises

a) Theoretical study: Honours modules in Extension that have not yet been taken;
b) A dissertation in the form of a situation specific development programme or based on appropriate research in the field of extension (AGV 891) (120 credits)

Due to the decline in enrolment numbers for this programme vis-à-vis the increasing demand to develop the research capability for Extension students, post-graduate students are of late required to register for EBW 801 (Research methodology in thesis design) instead of LOB 800.

6.3.3 PhD in Extension (Code 03262002)

Programme composition:

AGV 900	Agrarian extension 900	
AGV 990	Thesis: Agrarian extension 990	(360 credits)

6.4 ENVIRONMENTAL MANAGEMENT

6.4.1 MInstAgrar in Environmental Management (Coursework) (Code 03252132)

a. Admission requirements

Candidates must be in possession of a four-year university degree, i.e. honours level or equivalent. Candidates with no previous formal training in rural development have to complete two honours-level modules during their master's level training in order to obtain BInstAgrarHons status before being awarded an MInstAgrar degree. These are:

ARD 780	Rural development studies 780	(40 credits)
ARD 782	Physical-biological resources and development 782	(20 credits)

Final admission is subject to the approval of the Director of the Centre for Environmental Studies and the Director of the Postgraduate School for Agriculture and Rural Development.

b. Programme composition:

Compulsory core modules (40 credits):

ENV 810	Environmental paradigms 810	(20 credits)
ENV 816	Environmental law 816	(20 credits)

Compulsory specialisation modules (70 credits):

ZEN 811	Conservation and development 811	(30 credits)
ENS 811	Environment and development 811	(20 credits)
ENS 822	Strategic environmental management 822	(20 credits)

Elective module (20 credits):

At least one additional elective module must be selected in consultation with the Director of the Centre for Environmental Studies and the Director of the Post-

graduate School for Rural and Agricultural Development. Options will be based on the academic background and/or anticipated career of the candidate.

Research project (120 credits):
ENV 891 Research project 891 (120 credits)

Total credits required: 250

6.5 PLANT PRODUCTION

Coordinated in the Department of Plant Production and Soil Science.

Three focus areas are available: Agronomy, Horticultural science and Pasture science.

6.5.1 BInstAgrarHons in Plant Production (Code 03242031)

On completion of the degree candidates will have a clear understanding of all aspects relevant to the principles and practices of plant production. They should be able to design/improve/manage crop production systems for specific situations on a scientific basis. Students selecting the Pasture science electives will also have a holistic approach to the interaction between environment, plants (rangeland and pastures) and animals enabling them to develop and implement sustainable production systems for different agro-ecological/economic conditions.

To reach this objective, they must:

- understand the physiological basis of crop yield
- know the botany of crop plants
- have a thorough understanding of practices such as tillage, fertilization, cultivar selection, pest management, irrigation, harvesting and marketing of crops
- have applicable knowledge of subjects such as plant breeding, soil science and agricultural economics
- have a good grounding in ecology, physiology and taxonomy of rangeland and pasture plants with the Pasture science electives
- have a thorough understanding of the principles of range management with particular reference to range condition, grazing capacity, adapted animals and the use of such management strategies as burning, resting and rotational grazing
- with respect to planted pastures, be able to make recommendations with respect to crop selection, establishment, fertilization, irrigation and method of utilisation
- be able to integrate rangeland, pastures, crops and agro-forestry into viable livestock enterprises.

Programme composition:

Compulsory modules:

ARD 780	Rural development studies 780	(40 credits)
ARD 782	Physical-biological resources and development 782	(20 credits)
PGW 702	Scientific communication 702	(30 credits)
PGW 704	Research methodology 704	(15 credits)

Elective modules:
Four of the following or additional modules may be selected in consultation with the Director of the School and the head(s) of the relevant department(s). Choices will be based on the academic background and/or anticipated career of the candidate.

AGR 785	Crop production systems (I): Field crops 785	(15 credits)
AGR 786	Crop production systems(II): Vegetable crops 786	(15 credits)
PPR 712	Plant production: Herbicides and control 712	(15 credits)
PPR 713	Agroforestry 713	(15 credits)
WDE 781	Rangeland management 781	(15 credits)
WDE 782	Pasture science 782	(15 credits)
WDE 783	Integrated plant and animal production 783	(15 credits)
HSC 788	Production systems (I): Tropical fruit production 788	(15 credits)
HSC 789	Production systems (II):Temperate fruit production 789	(15 credits)
HSC 783	Topics in horticulture783	(15 credits)

Additional elective modules may be selected in consultation with the Director of the School and the head(s) of the relevant department(s).

Total credits required: 165

6.5.2 MInstAgrar in Agronomy (Code 03252072)

Programme composition:

AGR 891	Mini-dissertation: Agronomy 891	(120 credits)
AGR 801	Advanced coursework - Advanced modules in agronomy and related subjects in consultation with the Director of the School and the head of department	(120 credits)

Total credits required: 240

6.5.3 PhD in Agronomy (Code 03262164)

Programme composition:

AGR 900	Agronomy 900	(60 credits)
AGR 990	Thesis: Agronomy 990	(300 credits)

Total credits required: 360

6.5.4 MInstAgrar in Horticulture (Code 03252082)

Programme composition:

HSC 891	Mini-dissertation: Horticultural science	(120 credits)
HSC 801	Advanced coursework - Advanced modules in horticultural science and related subjects in consultation with the Director of the School and the head of department	(120 credits)

Total credits required: 240

6.5.5 PhD in Horticultural Science (Code 02260544)

Programme composition:

TBK 900	Horticultural science 900	(60 credits)
TBK 990	Thesis: Horticultural science 990	(300 credits)

Total credits required: 360

6.5.6 MInstAgrar in Pasture Science (Code 03252092)

Programme composition:

WDE 891	Mini-dissertation: Pasture science 891	(120 credits)
WDE 801	Advanced coursework 801- Advanced modules in pasture science and related subjects in consultation with the Director of the School and the head of the department	(120 credits)

Total credits required: 240

6.5.7 PhD in Pasture Science (Code 03262165)

Programme composition:

WDE 900	Pasture science 900	(60 credits)
WDE 990	Thesis: Pasture science 990	(300 credits)

Total credits required: 360

6.6 CROP PROTECTION

Coordinated in the Department of Microbiology and Plant Pathology.

There are two different focus areas available: Crop protection and Plant quarantine.

6.6.1 BInstAgrarHons in Crop Protection (Code 03242062)

On completion of the degree the candidate should be able to recognise and diagnose the diseases, insect pests and weeds causing losses to economically important crops, and know in principle how to control these diseases, pests and weeds. The candidate should also have a general knowledge of the factors influencing plant health and yield and be able to implement effective plant protection measures.

In order to achieve this, the candidate must:

- understand the basic principles of plant pathology, entomology and weed science in the context of plant protection;
- know the economically important plant diseases in terms of symptoms and development of the disease, biological properties of the causal organisms and control measures;
- understand the principles involved in chemical and non-chemical control of plant diseases;
- know the environmental conditions including soil factors influencing plant health.

a. Admission requirements:

Candidates must be in possession of the following basic university subjects before admission to the BInstAgrarHons in Crop Protection:
Chemistry - Elementary, general and organic chemistry
Biology - Plant anatomy and physiology.

Candidates are also expected to have the following modules, or equivalents, as background. If necessary these modules may be taken in addition to the prescribed modules during the study programme, or may be substituted for any of the BInstAgrarHons in Crop Protection required modules provided the candidate has been credited for the module in question:

Soil science	-	Introductory soil science (GKD 250)
Microbiology	-	Introductory microbiology (MBY 161)
Crop protection	-	Introductory crop protection (PLG 251)

b. Programme composition:

ARD 780	Rural development studies 780	(40 credits)
ARD 782	Physical-biological resources and development 782	(20 credits)
SIZ 711	Insect diversity: Economic and ecological implications 711	(20 credits)
PPR 712	Plant production: Herbicides and control 712	(15 credits)
PPT 780	Introductory plant pathology 780	(20 credits)
PPT 781	Plant pathology: Disease control 781	(20 credits)
SIZ 724	Integrated pest management 724	(20 credits)

Total credits required: 155

6.6.2 MInstAgrar in Crop Protection (Code 03252062)

There are three focus areas to choose from: Plant pathology, Entomology and Weed science.

Programmes are offered in the field of specialisation i.e. Plant pathology, Entomology or Weed science, in consultation with the Director of the School and/or the head of the division Plant Pathology. Choices will be based on the academic background and/or future career of the candidate.

Elective modules will be selected up to 120 credits (PPT 802 Advanced coursework) (120 credits).
A mini-dissertation PPT 892 (120 credits) must be done on a topic to be decided on in consultation with the Director of the School and the head of the relevant department.

Total credits required: 240

6.6.3 PhD in Crop Protection (Code 03262021)

Programme composition:

PPT 900	Plant pathology 900	(50 credits)
PPT 990	Thesis: Plant pathology 990	(350 credits)

Total credits required: 400

6.7 PLANT QUARANTINE

Coordinated in the Department of Microbiology and Plant Pathology.

6.7.1 BInstAgrarHons in Plant Quarantine (Code 03242151)

On completion of the degree the candidate should be well versed in recognising and diagnosing plant diseases and insect pests, particularly those of quarantine importance. The candidate should also have a general knowledge of phytosanitary requirements, quarantine pest risk assessment and trade regulations internationally and locally.
In order to achieve this, the candidate must:

- understand the basic principles of plant pathology and entomology in the context of plant quarantine;
- know the important quarantine pests and diseases;
- understand how these pests and diseases spread, survive and what their economic importance is;
- comprehend the principles involved in international trade regulations.

a. Admission requirements:

Candidates must be in possession of an acceptable bachelor's degree with the following basic university subjects before admission to the BInstAgrarHons in Plant Quarantine:
Chemistry - Elementary, general and organic chemistry
Biology - Plant anatomy and physiology.

b. Programme composition:

ARD 780	Rural development studies 780	(40 credits)
ARD 782	Physical-biological resources and development 782	(20 credits)
SIZ 711	Insect diversity: economic and ecological implications 711	(20 credits)
PPT 780	Introductory plant pathology 780	(20 credits)
PPT 781	Plant pathology: Disease control 781	(20 credits)
PPT 761	Sanitary and phytosanitary issues 761	(20 credits)
SIZ 724	Integrated pest management 724	(20 credits)

Total credits required: 160

6.7.2 MInstAgrar in Plant Quarantine (Code 03252141)

Programmes are offered in the field of specialisation in consultation with the Director of the School and the head of the relevant department. Choices will be based on the academic background and/or future career of the candidate. Elective modules up to 120 credits (PPT 803 Advanced coursework: Plant quarantine 803) (120 credits) should be selected.

A mini-dissertation (PPT 893) (120 credits) on a topic to be decided on in consultation with the Director of the School and the head of the relevant department.

Total credits required: 240

6.8 RURAL DEVELOPMENT PLANNING

Coordinated in the Department of Agricultural Economics, Extension and Rural Development.

6.8.1 BInstAgrarHons in Rural Development Planning (Code 03242023)

The aim of this programme is to enable graduates to participate in and lead rural development planning and management initiatives. It provides a broad-based understanding of development, project planning and analysis, strategic management and planning methodology.

Programme composition:

ARD 780	Rural development studies 780	(40 credits)
ARD 782	Physical-biological resources and development 782	(20 credits)
LEK 785	Agricultural project planning and appraisal 785	(15 credits)
RSG 720	Land law 720	(20 credits)
AGV 715	Principles and approaches of rural development and extension 715	(20 credits)
AGV 713	Communication for sustainable rural development 713	(20 credits)
LOB 800	Rural developmental management 800	(15 credits)

Total credits required: 150

6.8.2 MInstAgrar in Rural Development Planning (Code 03252023)

The candidate is required to pass at least 240 credits. A dissertation (180 credits) must be submitted, prepared under the guidance of a member of the academic staff. The modules required for the MInstAgrar degree in Rural Development Planning will be determined by the head of department.

Programme composition:
Modules as determined by the head of department.

Elective modules:

LEK 780	Introduction to natural resource and environmental economics 780	(15 credits)
LEK 784	Advanced rural finance 784	(15 credits)
ARD 784	Practical fieldwork 784	(10 credits)

Agrarian extension, Rural engineering or other electives that would strengthen the rural management focus.

Dissertation:
AGV 890: Dissertation: Agrarian Extension 890 - dissertation on a relevant aspect of rural development (180 credits).

Total credits required: 240

6.8.3 PhD: Rural Development Planning (Code 03262023)

Programme composition:

DPL 900	Rural development planning 900	
DPL 990	Thesis: Rural development planning 990	(360 credits)

Total credits required: 360

Alphabetical list of modules in the Faculty of Natural and Agricultural Sciences

 # = Concurrent registration
() = Examination admission
dpw = discussions per week
GS = combined (final) mark (semester/year mark plus examination mark) of at least 40% - 49%
hpw = hours per week
LP = Lecturer's permission
lpw = lectures per week
ppw = practicals per week
spw = seminars per week
TDH = Permission by head of department
tpw = tutorials per week

AGR 785 Crop production systems (I): Field crops 785
Academic organisation: Plant Production and Soil Science
Contact time: 2 lpw 1 ppw
Period of presentation: Semester 1
Language of tuition: English **Credits:** 15
Module content:
Integrated agronomic, climatic, soil, botanical, economic and managerial considerations in crop production systems aimed at maximum economic yield and sustainability. Case studies of specific field crops.

AGR 786 Crop production systems (II): Vegetable crops 786
Academic organisation: Plant Production and Soil Science
Contact time: 2 lpw 1 ppw
Period of presentation: Semester 2
Language of tuition: Both Afr and Eng **Credits:** 15
Module content:
Integrating agronomic, climatic, soil, botanical, economic and managerial considerations in crop production systems aimed at maximum economic yield and sustainability. Case studies of specific vegetable crops.

AGV 412 Leadership group dynamics 412
Academic organisation: Agricultural Economics, Extension and Rural Development
Contact time: 3 lpw
Period of presentation: Year
Language of tuition: English **Credits:** 20
Module content:
Community – concept and meaning; Leadership – concept and meaning. Community facilitation and dealing with diversity; hindrances to change. The use of small groups in the community; the use of large groups; group dynamics; group and community goals. The paradigm shift from directing to facilitating; group techniques; participative techniques. Leadership development in communities. Case studies.

AGV 413 Communication for sustainable rural development 413
Academic organisation: Agricultural Economics, Extension and Rural Development
Contact time: 2 lpw

Period of presentation: Year
Language of tuition: English **Credits:** 20
Module content:
Introduction to the communication process and its importance for sustainable development; the models of communication; critical elements and factors in communication; Communication and perception. Use of non-verbal communication. Persuasion and Credibility. Messages and message treatment; audience and audience identification; channels and methods of communication. Effective listening and feedback. Practical training in communication: Effective speaking; visual aids in communication; managing conflict; report writing. Introduction to Appreciative Inquiry as a communication approach.

AGV 415 Principles and approaches of rural development and extension 415
Academic organisation: Agricultural Economics, Extension and Rural Development
Contact time: 2 lpw
Period of presentation: Year
Language of tuition: English **Credits:** 20
Module content:
The role, importance and nature of extension and development; ethics in development and extension. International approaches to development and extension; paradigm shifts within extension and development. The Third World: concept, characteristics and change. The subsistence farmer, rural poverty and the deprivation trap. Development practice and theories. Participation; appropriate technology; role players and responsibilities in development.

AGV 421 Communication 421
Academic organisation: Agricultural Economics, Extension and Rural Development
Contact time: 2 lpw
Period of presentation: Semester 2
Language of tuition: Both Afr and Eng **Credits:** 20
Module content:
Communication: Definition and clarification of concepts. Theory and elements of communication. Verbal and non-verbal communication. Determinants of interpersonal communication. Abating factors impeding communication. Nature, classification and efficiency of communication channels.

AGV 426 Extension project planning and management 426
Academic organisation: Agricultural Economics, Extension and Rural Development
Contact time: 2 lpw
Period of presentation: Year
Language of tuition: English **Credits:** 20
Module content:
Nature, purpose and principles of a project-based and purposeful approach. Institutional framework for community participation, ownership and empowerment; linking with complementary and support services. Participative need appraisal, problem identification and delimitation; methods and techniques; problem conceptualisation and development of survey instrument; situation surveys and analyses; formulation of objectives; identification and scheduling of methods and activities; work plan or calendar construction, budgeting. Project monitoring tools.

AGV 428 Extension projects evaluation 428
Academic organisation: Agricultural Economics, Extension and Rural Development
Contact time: 2 lpw

Period of presentation: Year
Language of tuition: English **Credits:** 20
Module content:
Reasons and purposes of evaluation; expectations from evaluations; role players and motives in evaluation. Criteria and indicators of development, development projects and development organisations. Methods of evaluation; formulation of objectives and scale construction for evaluation; developing and coding the measuring instrument. Sampling and sampling techniques; data analysis and interpretation; compiling an evaluation report.

AGV 429 Human and organisational behaviour change and management 429
Academic organisation: Agricultural Economics, Extension and Rural Development
Contact time: 2 lpw
Period of presentation: Year
Language of tuition: English **Credits:** 20
Module content:
Understanding behaviour: characteristics of human behaviour and basic concepts; perception, decision making and problem solving, learning, innovativeness and adoption behaviour. Diffusion of Innovations: elements and phases of diffusion, opinion leaders and contact farmers, methodological implications for extension. Psychological, cultural and social barriers to change. Behaviour change or modification: comparison of different approaches and strategies. A practical model: background principles and theories, identifying “forces” or behaviour determinants; designing effective extension messages for development programmes. Introduction to organisational dynamics. Role of extension organisations in rural development. Theoretical perspectives on organisational change. Understanding organisations and society; organisational pathologies; organisational effectiveness.

AGV 712 Leadership and group dynamics 712
Academic organisation: Agricultural Economics, Extension and Rural Development
Contact time: 1 dpw 1 lpw
Period of presentation: Year
Language of tuition: English **Credits:** 20
Module content:
Nature, philosophy and objectives of Extension. The group as channel and instrument in extension; definitions and characteristics of groups; group formation; theories regarding the functioning of groups; group norms; group goals; small group techniques; rural groups and their engagement; definitions and theories of leadership; behaviour and attitude in group work; the extensionist as professional leader; group analysis in group context and process; training of leaders. Conflict resolution, mediation and negotiation. Ethics in extension and agricultural development. Management in extension; Strategic planning; functions of management.

AGV 713 Communication for sustainable rural development 713
Academic organisation: Agricultural Economics, Extension and Rural Development
Contact time: 2 lpw 1 ppw 1 dpw
Period of presentation: Year
Language of tuition: English **Credits:** 20
Module content:
Introduction to the Communication Process, its role and importance. Communication and perception – role of Extension in AKIS. Clarification of principles and definitions; theory of communication; strategies for communication and extension methods. Key elements and

channels of communication; credibility; persuasion; public speaking; audiovisual aids; mass media and their effect; new reporting; articles and newsletters. Designing communication interventions. Impact assessment approaches and tools. Appreciative Communication Inquiry: 5-D Approach.

AGV 715 Principles and approaches of rural development and extension 715
Academic organisation: Agricultural Economics, Extension and Rural Development
Contact time: 1 lpw 1 dpw
Period of presentation: Year
Language of tuition: English **Credits:** 20
Module content:
Overview of the origin, role, development of extension; Philosophy and principles of extension. International approaches to extension delivery: Training and visit, farming system development, project approach, farmer field schools, participatory extension and participatory technology development. Extension's role in sustainable agriculture development; adult learning principles, privatizing and outsourcing of agricultural extension; the role of non-governmental organisations (NGO's) in extension delivery. Decentralisation of extension. Participation and coordination of stakeholders in the planning of linkages between extension, research and the farming community.

AGV 726 Extension programme planning and management 726
Academic organisation: Agricultural Economics, Extension and Rural Development
Contact time: 1 dpw 2 lpw 1 ppw
Period of presentation: Year
Language of tuition: English **Credits:** 20
Module content:
Nature, purpose and principles of a programmed and purposeful Extension. The philosophy, principles and assumptions of program development. Institutional framework for community participation, ownership and empowerment; linking with complementary and support services. Overview of the program cycle: consideration, survey, planning, action and evaluation phases. Participatory need appraisal, problem identification and delimination; problem conceptualisation and development of survey instrument; situation surveys and analysis; formulation of objectives; identification and scheduling of methods and activities; work plan of calendar construction, budgeting. The project management process. Personnel management and administration.

AGV 728 Extension programme evaluation 728
Academic organisation: Agricultural Economics, Extension and Rural Development
Contact time: 2 lpw 1 ppw 1 dpw
Period of presentation: Year
Language of tuition: English **Credits:** 20
Module content:
Meaning, scope and place of evaluation in extension; definition of a science; the science of extension; the research and evaluation process; problem identification; theory and hypotheses; objectives; literature research and information sources; sampling; methods of data collection; criteria of efficiency; quality of measuring instruments; scale construction; interviewing; statistical methods; reporting research findings; computer programming.

AGV 729 Human and organisational behaviour change and management 729
Academic organisation: Agricultural Economics, Extension and Rural Development
Contact time: 1 dpw 2 lpw
Period of presentation: Year

Language of tuition: English **Credits:** 20
Module content:
Understanding behaviour: characteristics of human behaviour and basic concepts; perception, decision making and problem solving, learning, innovativeness and adoption behaviour; Diffusion of innovations: elements and phases of diffusion, opinion leaders and contact farmers, methodological implications for extension. Psychological, cultural and social barriers to change. Behaviour change or modification: comparison of different approaches and strategies. A practical model: background principles and theories, identifying "forces" or behaviour determinants; designing effective extension messages for development programmes. Introduction to organisational dynamics. Role of extension organisations in rural development. Theoretical perspectives on organisational change. Understanding organisations and society; organisational pathologies; organisational effectiveness.

AKM 705 Actuarial mathematics 705
Academic organisation: Insurance and Actuarial Science
Contact time: 3 lpw
Period of presentation: Semester 1
Language of tuition: English **Credits:** 24
Module content:
The stochastic approach to annuities and assurances involving one of two lives. Definitions, estimation and use of select mortality functions. Multiple decrements and pension funds. Variable benefit, disability, long-term care contracts. Life insurance contracts: expenses and bonuses. Net and gross premiums and reserves for fixed and variable benefit contracts. Discounted emerging cost techniques. Profit testing. Asset shares for life insurance contracts. Alterations to contracts. Costs of guarantees under life insurance contracts. Factors affecting mortality, selection, standardisation. The process of population projection and its main determinants. Valuation of benefits under a disability insurance contract.

APZ 782 Primary veterinary health 782
Academic organisation: Animal and Wildlife Sciences
Contact time: 1 ppw 2 lpw
Period of presentation: Semester 1
Language of tuition: English **Credits:** 30
Module content:
Animal health and welfare of livestock; manifestations of disease and principles of pathology and autopsy; appropriate diagnostic methods and notifiable diseases; veterinary public health; disease surveillance; epidemiology and disease control; socio-economic aspects of primary veterinary health care.

ARD 780 Rural development studies 780
Academic organisation: Agricultural Economics, Extension and Rural Development
Contact time: 1 lpw
Period of presentation: Year
Language of tuition: English **Credits:** 40
Module content:
Overview of the concepts and theories of rural development including evolution of rural development theories, role of agriculture in rural developments, natural resource base and role of government. Rural livelihood systems focusing on household farming systems, decisions and operation of farming systems, the farm as a social system, non-farm, off-farm small, micro- and medium enterprises in the rural economy, development

intervention and household food security. Rural institutions including local governance, community-based and farmer organisations, agricultural credit and rural finance, input and output markets, human capital formation, land tenure and land reform, policy making institutions, and institutions of the agricultural knowledge triangle (research, teaching and extension). The relationship between rural sociology, community development and extension; physical and social structures of communities; cultural relativism; sustainability; indigenous knowledge; social stratification; development as change; principles and functions of community development; development barriers; participatory development methodologies, rural poverty. Methodologies for rural development including farming systems approach, participatory appraisal techniques, assessment of land-use patterns and agrarian systems in rural settings: zoning techniques, socio-economic and technical assessment of the farming system, topological techniques and gender sensitive methodologies. Communication for rural development and planning rural development at local levels. Practical assignment in collaboration with rural communities managed by the School's outreach department.

ARD 781 Development principles: Theory and evidence 781
Academic organisation: Agricultural Economics, Extension and Rural Development
Contact time: 1 lpw
Period of presentation: Semester 1
Language of tuition: English **Credits:** 20
Module content:
*Co-ordinated in the Department of Agricultural Economics, Extension and Rural Development. (Only for Extension students and covers first part of ARD 780)
Overview of concepts, theories and key definitions of development and rural development, poverty and food security to understand the magnitude and different dimensions of rural development in developing countries; evolution of rural development theories, policies and practices along recent history; the dynamic role of agriculture in the development process at country level and the successive phases of its contribution from early developing stages to industrial economies; smallholder agriculture and development; concepts and dimensions of rural livelihoods as the basis cluster of rural development; farming systems in smallholder agriculture; rural non-farm enterprises; food security and development; institutions and rural development; land tenure systems, property rights and land reform; rural finance and agricultural credit; agricultural markets with some policy and implementation dimensions; local institutions, property rights and collective action in communities; development support interventions.

ARD 782 Physical-biological resources and development 782
Academic organisation: Agricultural Economics, Extension and Rural Development
Contact time: 4 lpw
Period of presentation: Semester 2
Language of tuition: Both Afr and Eng **Credits:** 20
Module content:
Review of the most important physical-biological agricultural resources – soil, water, climate, topography, plant species, animal species; differences in characteristics, quality and vulnerability; the concept of optimum land-use; resource conservation; general ecological principles; examples of problems caused by mismatching of physical-biological resources and land use during development planning; principles of sensible technology transfer.

ARD 784 Practical fieldwork 784
Academic organisation: Agricultural Economics, Extension and Rural Development

Period of presentation: Quarter 1
Language of tuition: English **Credits:** 10
Module content:
A compulsory outreach module for all honours and MInstAgrar students specialising in Rural Development Management and Planning. Students in other disciplines may take it as an elective. The module entails the following:

- Students engaging with the communities in the rural development process.
- Exposing honours and master's students to the realities and problems of rural life in a way that they will gain enhanced understanding and commitment for making constructive contributions to improving rural life.
- Participating in capacity building of rural communities especially among the dis-advantaged groups.
- Case study based participatory research on priority issues identified with communities.

This module is an essential component of the Rural Development Studies module (ARD 780).

BCM 771 Trends in biochemical research 771
Academic organisation: Biochemistry
Contact time: 1 dpw
Period of presentation: Year
Language of tuition: English **Credits:** 18
Module content:
Study and discussion of topical research results from recent scientific publications.

BCM 773 Research project and report 773
Academic organisation: Biochemistry
Contact time: 1 other per week
Period of presentation: Year
Language of tuition: English **Credits:** 70

BCM 774 Research methods 774
Academic organisation: Biochemistry
Prerequisites: Admission into BScHons in Biochemistry, Biotechnology, Genetics, Microbioloby, Bioinformatics or Human Physiology
Contact time: A block of four weeks of practical training (160 hours) and 1 lpw over both semesters
Period of presentation: Year 1
Language of tuition: English **Credits:** 36
Module content:
Students are guided through the methodology of research planning and data handling, as well as science communication skills. They are offered hands-on experience in a range of advanced techniques employed in biochemistry, molecular technologies and biochemical analysis. Scientific writing and presentation skills required for research in biochemistry, are also addressed. Ethical and philosophical issues in the broader field of the Cellular and Molecular Sciences are also addressed. Several of these aspects will be presented collaboratively by the Department of Genetics and the Department of Microbiology and Plant Pathology.

BCM 775 Advanced biochemistry 775
Academic organisation: Biochemistry
Prerequisites: Admission into BScHons in Biochemistry, Genetics, Microbioloby,

Bioinformatics or Human Physiology
Contact time: 1 lpw over both semesters
Period of presentation: Year 1
Language of tuition: English **Credits:** 18
Module content:
The latest trends towards a biological systems approach of metabolism, functional genomics and control. This includes integration of metabolic pathways, mechanisms of regulation and metabolic control analysis.

BIF 701 Bioinformatics theory and applications 701
Academic organisation: Biochemistry
Contact time: 2 lpw 2 ppw
Period of presentation: Year
Language of tuition: English **Credits:** 32
Module content:
General concepts in bioinformatics; sequence motifs and features; sequence databases; common bioinformatics tools; programming in Python; the bioinformatics toolkit for Python; pairwise and multiple sequence alignments; genome analysis; data visualisation; specialised statistics for bioinformatics; specialised algorithms for bioinformatics; nucleic acid modelling; transcription analysis; microarray data analysis; genome annotation; phylogenetics; mapping and markers; structural modelling.

BIF 702 Trends in bioinformatics and literature seminar 702
Academic organisation: Biochemistry
Contact time: 1 lpw
Period of presentation: Year
Language of tuition: English **Credits:** 9
Module content:
Study and discussion of topical research results from recent scientific publications.

BIF 703 Research project and report 703
Academic organisation: Biochemistry
Contact time: 1 other per week
Period of presentation: Year
Language of tuition: English **Credits:** 35

BIF 704 Introduction to molecular biology for bioinformatics 704
Academic organisation: Biochemistry
Contact time: 1 lpw
Period of presentation: Year
Language of tuition: English **Credits:** 18
Module content:
Atoms and molecules; the chemistry of life, organisation of the cell; energy; chromosomes; heredity; DNA; RNA and protein synthesis; gene regulation; genetic engineering; genomes; genes and development; evolution; speciation; diversity.

BNG 700 Investments 700
Academic organisation: Insurance and Actuarial Science
Contact time: 2 lpw
Period of presentation: Year
Language of tuition: English **Credits:** 40

Module content:
The module covers a whole range of finance- and investment-related topics within the framework of the actuarial control cycle: principles and objectives of investment management and analysis of investors' needs. Principal investment assets and the markets in such assets as well as the economic influences on these. Asset modelling. The underlying legislative, taxation and regulatory framework for investment management and the securities industry. Actuarial techniques for assessing capital investment projects. Constructing investment indices. Developing appropriate investment strategies. Valuing individual investments and portfolios and understanding its appropriateness in different situations. Portfolio management (including risk control techniques) and performance appraisal of investment portfolios. Project management. Credit risk and credit ratings.

BOT 712 Plant nomenclature 712
Academic organisation: Plant Science
Contact time: 1 lpw 1 ppw
Period of presentation: Semester 1
Language of tuition: English **Credits:** 10
Module content:
The regulations of the International Code for Botanical Nomenclature. Principles of nomenclature. History of plant collecting. Type specimens.

BOT 714 Seed ecology 714
Academic organisation: Plant Science
Contact time: 1 web-based period per week 1 ppw 1 lpw
Period of presentation: Semester 1
Language of tuition: English **Credits:** 10
Module content:
Basic terminology and background regarding additions and losses in the seed bank (predation, dormancy, germination mechanisms, seed dispersal). Seed bank. Role of seed bank in management, conservation and rehabilitation.

BOT 717 Plant morphology 717
Academic organisation: Plant Science
Contact time: 1 lpw 1 ppw
Period of presentation: Semester 1
Language of tuition: English **Credits:** 10
Module content:
Speciation in flowering plants; plant variation. Sex determination in flowering plants. Reproductive systems in flowering plants.

BOT 718 Introduction to plant biotechnology 718
Academic organisation: Plant Science
Contact time: 1 lpw 1 ppw
Period of presentation: Semester 1
Language of tuition: English **Credits:** 10
Module content:
Plant genome: structure and composition of the plant genome (nuclear, mitochondrial and chloroplast); applications in plant biotechnology: plant tissue culture (microproagation, somatic embryogenesis and cell suspension cultures). Genetic manipulation and gene transfer technology (Agrobacterium-based and other) and DNA-marker technology.

BOT 719 Primary plant metabolism 719
Academic organisation: Plant Science
Contact time: 1 ppw 1 web-based period per week 1 dpw
Period of presentation: Semester 1
Language of tuition: English **Credits:** 10
Module content:
Regulation and interaction of primary plant metabolic pathways on the sub-cellular and whole plant level.

BOT 721 Plant community ecology 721
Academic organisation: Plant Science
Contact time: 1 lpw 1 ppw
Period of presentation: Semester 2
Language of tuition: English **Credits:** 10
Module content:
The study of vegetation, theory and practical applications, methods of data collection, data analysis and data management to study plant communities and vegetation gradients. Classification and ordination. Plant-environment interaction and environmental interpretation of plant communities.

BOT 722 General plant ecology 722
Academic organisation: Plant Science
Contact time: 1 web-based period per week 1 lpw
Period of presentation: Semester 2
Language of tuition: English **Credits:** 10
Module content:
Essays on relevant new ideas in plant ecology.

BOT 741 Plant taxonomy 741
Academic organisation: Plant Science
Contact time: 1 lpw 1 ppw
Period of presentation: Semester 2
Language of tuition: English **Credits:** 10
Module content:
Classification, identification and nomenclature, methodology of a revision study, analysis and presentation of taxonomic information, evolution, phylogeny and cladistics.

BOT 742 Plant classification 742
Academic organisation: Plant Science
Contact time: 1 ppw 2 lpw
Period of presentation: Semester 2
Language of tuition: English **Credits:** 20
Module content:
Sources of taxonomic information; morphology, anatomy, chemotaxonomy, cytogenetics, reproductive biology, plant geography, palynology, ethnobotany and paleobotany. Importance of different characteristics, methods to obtain information and interpretation of observed patterns in variation.

BOT 746 Applications in plant biotechnology 746
Academic organisation: Plant Science
Contact time: 1 lpw 1 ppw
Period of presentation: Semester 2

Language of tuition: English **Credits:** 10
Module content:
Creation of genetically modified plants and their impact on modern agriculture.

BOT 748 Phytopharmacology 748
Academic organisation: Plant Science
Contact time: 1 ppw 1 dpw
Period of presentation: Semester 1
Language of tuition: English **Credits:** 10
Module content:
Pharmacological action of low molecular plant constituents and high molecular weight compounds. Plant constituents as anticancer, antibacterial, antiviral, hypoglycaemic, free-radical scavengers, hypotensive and as anti-inflammatory agents. Cell culturing, cell growth and apoptosis, cell mediated immune responses. Drug development in TB as models for research. Enzymes, receptors and plant constituents. The unique challenges of plant-based medicines.

BOT 749 Pharmacognosy/Phytotherapy 749
Academic organisation: Plant Science
Contact time: 1 dpw 1 ppw
Period of presentation: Semester 1
Language of tuition: English **Credits:** 10
Module content:
Basic concepts of toxicology. Systemic, developmental, genetic and organ-specific toxic effects. Hallucinogenic, allergenic, teratogenic and other toxic plants. Plant constituents, contradictions and interactions. Phytotoxicity unrelated to plant constituents. Safety and efficacy issues of commonly used phyto-drugs with emphasis on pharmaceutical applications. Practical aspects related to the manufacture of good quality plant-based medicines. Phyto-drug formulation, standardisation and aspects concerning different dosage forms.

BOT 761 Advanced phytomedicine 761
Academic organisation: Plant Science
Contact time: 1 lpw 1 ppw
Period of presentation: Semester 2
Language of tuition: English **Credits:** 10
Module content:
Metabolism and functions of secondary compounds such as tannins, alkaloids, terpenoids, flavonoids and free amino acids. Importance of secondary compounds in the defence mechanisms of plants. Isolation and identification of medicinal bioactive compounds from plants. Their current scope and potential applications in ethnobotany. Strategies to discover new pharmaceuticals from ethnomedicine.

BOT 781 Veld evaluation and management 781
Academic organisation: Plant Science
Contact time: 2 lpw
Period of presentation: Semester 1
Language of tuition: English **Credits:** 10
Module content:
Analysis of pattern and dynamics of vegetation. Qualitative and quantitative analysis. Analytical and synthetical characteristics of the woody and herbaceous components. Biomass. Productivity. Veld condition and grazing capacity.

BOT 782 Research report 782
Academic organisation: Plant Science
Period of presentation: Semester 1
Language of tuition: English **Credits:** 50
Module content:
Teaching and planning, execution and documentation of a research project.

BOT 783 Seminar 783
Academic organisation: Plant Science
Period of presentation: Semester 1
Language of tuition: English **Credits:** 20
Module content:
Literature study of a subject related to the main discipline.

BOT 784 Seminar 784
Academic organisation: Plant Science
Period of presentation: Semester 2
Language of tuition: English **Credits:** 20
Module content:
Literature study of a subject related to one of the elective disciplines.

BOT 785 Vegetation of South Africa 785
Academic organisation: Plant Science
Contact time: 1 lpw
Period of presentation: Semester 1
Language of tuition: English **Credits:** 10
Module content:
Veld types with special reference to management and conservation.

BOT 786 Plant taxonomy 786
Academic organisation: Plant Science
Contact time: 2 lpw
Period of presentation: Semester 1
Language of tuition: Double Medium **Credits:** 10
Module content:
Plant taxonomy with special reference to identifying taxons. Variation in seed plants with reference to production systems, intra-specific variation and ecotypes.

BOT 787 Plant dynamics and phenology 787
Academic organisation: Plant Science
Contact time: 1 lpw
Period of presentation: Semester 2
Language of tuition: English **Credits:** 10
Module content:
Plant succession, types, causes, paths and tendencies in succession. Methods for monitoring of vegetation change, primary and secondary succession (examples), climax and stability are discussed. This is followed by a discussion of periodicity, climate, phenophases, seasonality, phenomeric analysis of plants, applications and nutritional and habitat preferences of ruminants.

BOT 788 Plant classification 788
Academic organisation: Plant Science
Contact time: 2 lpw

Period of presentation: Semester 2
Language of tuition: English **Credits:** 10
Module content:
Vegetation classification. The theory and practice of plant survey techniques, data analysis and classification of vegetation are discussed. Specific themes include: aerial photograph interpretation, habitat analysis and measuring of relevant habitat factors, identification of homogeneous vegetation units, plant classification, determining vegetation and habitat gradients within homogeneous areas, vegetation degradation and the influences of such degradation on veld condition.

BTW 701 Biotechnology in the workplace 701
Academic organisation: Genetics
Period of presentation: Year
Language of tuition: English **Credits:** 18
Module content:
Introduction to the principles and realities of working in the field of biotechnology. Discussions on various aspects, including entrepreneurship; intellectual property; patent rights; financial management; grant applications and product marketing. The module will be assessed by way of a simulated grant application for the development of a hypothetical biotechnological venture.

CMY 710 Analytical chemistry 710
Academic organisation: Chemistry
Contact time: 2 dpw
Period of presentation: Year
Language of tuition: English **Credits:** 28
Module content:
Selected aspects of –
Mass spectrometry: ion sources, analysers, detectors, isotope ratios, accurate mass, ion fragmentation, tandem mass spectrometry.
Chromatography: theory and instrumentation of gas, liquid and supercritical fluid chromatography, multi-dimensional systems and coupling to mass spectrometry.
Electrochemistry: fundamental theory, voltammetry, metal-ligand equilibria, modelling and measurement of solution composition.
Statistics: precision and accuracy, random errors, hypothesis testing, method of least squares, curve fitting, multivariate statistics, interpreting patterns of data.
Chemical metrology: propagation of errors, quality control of quantitative and qualitative analytical information, international standards, interlaboratory calibration.

CMY 711 Organic chemistry 711
Academic organisation: Chemistry
Contact time: 2 dpw
Period of presentation: Year
Language of tuition: English **Credits:** 28
Module content:
Stereocontrolled organic synthesis: synthesis from chiral pool compounds; substrate stereocontrol in diastereoselective synthesis and pericyclic reactions; chiral auxiliaries in synthesis; reagent controlled synthesis; catalyst controlled synthetic methods.
Popular modern synthetic transformations and reagents: oxidations and reductions; formation of C–C double bonds; metal mediated formation of C–C single bonds.
Retrosynthesis: principles and applications.

CMY 712 Inorganic chemistry 712
Academic organisation: Chemistry
Contact time: 2 dpw
Period of presentation: Year
Language of tuition: English **Credits:** 28
Module content:
Inorganic and organometallic chemistry. Classification of ligands and complexes. Synthesis, structure, bonding and reactivity of complexes. Modelling. From complexes to clusters to networks. Reaction kinetics and mechanisms. Main group chemistry. Bioinorganic and bioorganometallic compounds. Metals in medicine. Homogeneous catalysis and template effects.

CMY 713 Physical chemistry 713
Academic organisation: Chemistry
Contact time: 2 dpw
Period of presentation: Year
Language of tuition: English **Credits:** 28
Module content:
A selection of the following topics is presented:
Crystallography: theoretical principles, theory of crystals, X-rays, crystallographic techniques, structure determinations, powder diffraction and crystallographic data bases.
Molecular modelling: molecular structure/energy, methodology, principles and applications of computational chemistry.
Chemical kinetics: rates of chemical reactions, reactions in the gas and solution phases, complex reactions, and solid state reactions.
Statistical mechanics: partition functions, thermodynamic functions, equilibria, aspects of materials: polymorphism, defects, band theory, phase diagrams.
Symmetry: symmetry elements and operations, point groups, applications to orbital theory, and spectroscopy.
Chemical bonding: quantum chemistry, sigma bonding, hybrid orbitals, pi-bonding and multi-centre bonding.

CMY 729 Project 729
Academic organisation: Chemistry
Contact time: 1 spw
Period of presentation: Year
Language of tuition: English **Credits:** 48
Module content:
Students work on two projects during the year as members of two different research groups in the Department. A report and a presentation for each project are required.

EKT 720 Econometrics 720
Academic organisation: Statistics
Prerequisite: RAL 780
Contact time: 1 lpw 1 web-based period per week
Period of presentation: Semester 2
Language of tuition: English **Credits:** 20
Module content:
The emphasis is on the theoretical understanding and practical application of advanced econometric and regression modelling. The following topics are covered:
Single equation models: Nonparametric regression. Bootstrap procedures within regression analysis, k-nearest neighbour classification. Modelling categorical dependent

variables – Logit / Probit models. Multiple outputs. Linear regression of an indicator matrix. Ridge regression. Non-linear regression modelling. Some new developments in regression and classification. Simultaneous equation models: Specification, identification and estimation of simultaneous equation models.

ENV 700 Research project 700
Academic organisation: Geography, Geoinformatics and Meteorology
Period of presentation: Year
Language of tuition: English **Credits:** 30
Module content:
An individual research project carried out under the guidance of a lecturer. The outcome of the project is a research report in the format of a research paper. Due to the interdisciplinary nature of Environmental science, students are given the freedom to select topics in different core principles. They are also expected to obtain the respective skills (theoretical and practical research techniques, data analysis, communication and computer skills) necessary for the research topic.
Two compulsory seminars are offered at the beginning of the year (2 x5 hrs) to help students formulate project proposals. Based on the nature of the project proposals students are allocated to a supervisor who then schedules individual contact sessions for follow-up, feedback and assistance throughout the year, to ensure sufficient progress and completion of the project.

ENV 703 Research and presentation skills 703
Academic organisation: Geography, Geoinformatics and Meteorology
Period of presentation: Year
Language of tuition: English **Credits:** 10
Module content:
A module zooming in on research methodologies, data-capturing techniques as well as visual and oral presentation skills. A significant part of the module assessment is constituted by the final presentation of the honours project contents.

ENV 711 Environmental principles 711
Academic organisation: Geography, Geoinformatics and Meteorology
Contact time: 1 lpw
Period of presentation: Semester 1
Language of tuition: English **Credits:** 20
Module content:
The module provides a critical review of the structures and paradigms in which the environmental sciences are practised. The historical and philosophical development, current thought and principles of the environmental sciences and the manner in which environmental issues are dealt with, are addressed.

ENV 727 Environmental compliance 727
Academic organisation: Geography, Geoinformatics and Meteorology
Contact time: 5 lpw
Period of presentation: Semester 2
Language of tuition: English **Credits:** 20
Module content:
Tools for achieving environmental compliance, constitutional and administrative requirements, environmental legislative requirements, criminal legislative requirements, business entities and liability, mandate and powers of environmental inspectors, enforcement ethics, networks and resources, conflict management.

ENV 728 Conservation environmental enforcement 728
Academic organisation: Geography, Geoinformatics and Meteorology
Contact time: 5 lpw
Prerequisite: ENV 727
Period of presentation: Semester 2
Language of tuition: English **Credits:** 20
Module content:
Health and safety during conservation enforcement, compliance inspection principles in biodiversity conservation, principles of investigation, approaches and procedures during prosecution.

ENV 729 Industrial environmental enforcement 729
Academic organisation: Geography, Geoinformatics and Meteorology
Contact time: 4 dpw
Period of presentation: Semester 2
Language of tuition: English **Credits:** 20
Module content:
Health and safety during industrial enforcement, compliance inspection principles in industry, principles of investigation, environmental sampling and chain of custody of samples, interaction with ISO 14001, procedures during prosecution.

ENV 785 Environmental impact assessment and auditing 785
Academic organisation: Geography, Geoinformatics and Meteorology
Contact time: 1 lpw
Period of presentation: Year
Language of tuition: English **Credits:** 20
Module content:
The module focuses on procedures and methods used to manage the environment. While the main focus is on determining the impact of human activities on the environment, the module also considers aspects such as monitoring, auditing, and evaluating environmental management practices. The topics covered may include, amongst others, Environmental Impact Assessment (EIA), Social Impact Assessment (SIA), Integrated Environmental Management, Stategic Environmental Assessments (SEA), Environmental Management Frameworks (EMF), Environmental Management Systems (EMS), and ISO14001.

FNI 700 Finance and investment 700
Academic organisation: Insurance and Actuarial Science
Prerequisite: BNG 700 #
Contact time: 2 lpw for 14 weeks
Period of presentation: Semester 2
Language of tuition: English **Credits:** 40
Module content:
The application of modern techniques in financial management to the financing of corporate entities and the management of assets. Topics include: the theory of finance, valuation of investments, asset modelling, capital structure and the cost of capital, portfolio management, capital project appraisal and performance management.

FSK 700 Physics 700
Academic organisation: Physics
Contact time: 1 other per week 1 dpw 1 spw 10 lpw
Period of presentation: Year

Language of tuition: Both Afr and Eng **Credits:** 160
Module content:
The module content is determined by the Head of the Department of Physics. In addition to the usual subjects, viz. classical mechanics, quantum mechanics, statistical mechanics, electrodynamics, solid state physics, experiments or modelling, and a mini-research project, there are also elective subjects.

FSK 710 Mathematical methods 710
Academic organisation: Physics
Contact time: 6 lpw
Period of presentation: Semester 1
Language of tuition: Both Afr and Eng **Credits:** 15
Module content:
Series; complex analysis; Bessel and other special functions; integral transforms; Green functions

FSK 711 Classical dynamics 711
Academic organisation: Physics
Contact time: 6 lpw
Period of presentation: Semester 1
Language of tuition: Both Afr and Eng **Credits:** 15
Module content:
Advanced problems in classical dynamics; Hamilton formalism; canonical transformations; continuum mechanics

FSK 713 Quantum mechanics (I) 713
Academic organisation: Physics
Contact time: 4 lpw
Period of presentation: Semester 1
Language of tuition: Both Afr and Eng **Credits:** 15
Module content:
Measurement process, General indefinite relations, Harmonic ossilator, symmetry, invariants and conservation laws, angular momentum, spin, perturbation theory, Schrödinger-Heisenberg and interaction pictures.

FSK 714 Electrodynamics (I) 714
Academic organisation: Physics
Contact time: 4 lpw
Period of presentation: Semester 1
Language of tuition: Both Afr and Eng **Credits:** 15
Module content:
Poisson equation, Green functions, Maxwell equations.

FSK 727 Nuclear physics 727
Academic organisation: Physics
Contact time: 4 lpw
Period of presentation: Semester 1
Language of tuition: English **Credits:** 12
Module content:
Collective model, shell model, approximate nuclear structure methods, for example Hartree-Fock, random phase approximation, Tamm-Dankoff reaction theory and optical model.

FST 700 Research methodology and seminars 700
Academic organisation: Food Science
Contact time: 1 workshop of 5 days in semester 1, 1 day seminar in semester 2
Period of presentation: Year
Language of tuition: English **Credits:** 20
Module content:
Lectures and assignments: Research methodology. Literature study and seminar presentations on topics in Food Science and/or Technology. The candidate must also pass an oral examination at the end of the module.

FST 701 Animal food technologies 701
Academic organisation: Food Science
Contact time: 30 discussion classes 9 practical sessions
Period of presentation: Year
Language of tuition: English **Credits:** 20
Module content:
Dairy technology: The technology of fluid, concentrated, dried, frozen and fermented dairy products and starter cultures. Requirements for milk supply and other ingredients. Principles for the manufacturing of products in this category. Possible defects, causes and prevention.
Practical work: Preparation of condensed milk, custard, ready-to-eat milk-based desserts, flavoured milk beverages, dairy-fruit juice mixtures; ice cream and other frozen desserts; yoghurt and cultured milk products; cheeses. Evaluation and analysis of the products. Effect of processing on the nutritional value of dairy products. Factory visits.
Meat, poultry, fish and egg technology: Meat, poultry, fish and egg processing and equipment. Meat emulsion, curing, dehydration and fermentation technology. Preservation and storage. Packaging. Legislation. Quality control and hygiene. Effect of processing on the nutritional value of meat products.
Practical work: Manufacturing of dried, cured, fermented and emulsion type products. Visits to processing factories.

FST 702 Advanced plant food science and technologies 702
Academic organisation: Food Science
Contact time: 5 discussion classes in semester 2, 8 discussion classes in semester 1 3 practical sessions in semester 2 5 practical sessions in semester 1
Period of presentation: Year
Language of tuition: English **Credits:** 20
Module content:
Plant food functionality: Starch, non-starch polysaccharides, protein. Advanced rheology and texture. Malting and brewing. Ready-to-eat (RTE) technologies and their impact on functional and nutritional quality. Plant oil processing. Minimal processing of fruits and vegetables. Practical work: Pasting properties of starch; Dough rheology; Isolation of legume and cereal proteins; SDS-PAGE electrophoreses of legume and cereal proteins; Malting and mashing of sorghum and barley male; Extraction of essential oils; Extraction and identification of phenolic compounds; Minimal processing of fruit and vegetables.

FST 712 Sensory evaluation 712
Academic organisation: Food Science
Contact time: 12 discussion classes, 6 practical sessions
Period of presentation: Semester 1
Language of tuition: English **Credits:** 10

Module content:
Lectures: Principles and applications of sensory evaluation. Types of panels, tests and test conditions and their functions. Selection and training of panellists for descriptive sensory evaluation. Instrumental sensory quality measurements. Statistical analysis and interpretation of data.
Practicals: Practical aspects and execution of sensory evaluation techniques, analysis and interpretation of data. Instrumental sensory quality measurements.

FST 713 Product development and quality management 713
Academic organisation: Food Science
Contact time: 6 practical sessions 15 discussion classes
Period of presentation: Semester 1
Language of tuition: English **Credits:** 30
Module content:
Lectures: Principles involved and steps that are followed to develop new food products that are safe, tasty, nutritious and cost effective. Application of the theory of food product development. Quality management systems with specific reference to Good Manufacturing Practices, HACCP and ISO 9000. National and international standards, Codex Alimentarius, FDA. Application of food legislation. Food packaging.
Practicals: A product development project will be planned, conducted and presented. Application and implementation of HACCP.

FST 714 Research methodology 714
Academic organisation: Food Science
Contact time: 1 workshop of 5 days in semester 1
Period of presentation: Semester 1
Language of tuition: English **Credits:** 8
Module content:
Five-day intensive Research methodology workshop: Philosophy of research; Where to start research – Problem statement; Role and importance of the literature review; How to formulate hypotheses and objectives; Experimental design; The good practical way to do research, including getting the results down; Application of statistics to research; Writing an honours report/master's dissertation/doctoral thesis; Writing a scientific paper; Preparing and presenting posters and oral papers.

FST 720 Advanced food science 720
Academic organisation: Food Science
Contact time: 12 discussion classes
Period of presentation: Year
Language of tuition: English **Credits:** 20
Module content:
Discussion classes in advanced level food chemistry, food microbiology, food engineering, food processing and nutrition. Problem solving and literature discussion.

FST 763 Research project 763
Academic organisation: Food Science
Period of presentation: Year
Language of tuition: English **Credits:** 40
Module content:
A short research project on an approved topic in food science and/or technology is planned, executed and presented in the form of a written report.

GDK 771 Advanced environmental soil chemistry 771
Academic organisation: Plant Production and Soil Science
Period of presentation: Year
Language of tuition: English **Credits:** 15
Module content:
Advanced theoretical and experimental soil chemistry, including the organic fraction.

GDK 772 Advanced environmental soil physics 772
Academic organisation: Plant Production and Soil Science
Period of presentation: Year
Language of tuition: English **Credits:** 15
Module content:
Advanced theoretical soil physics with the emphasis on mathematical modelling of fluxes of water, heat and solutes.

GDK 773 Plant nutrition, soil biology and soil fertility 773
Academic organisation: Plant Production and Soil Science
Period of presentation: Year
Language of tuition: English **Credits:** 15
Module content:
Study of the latest trends and developments in plant nutrition, soil biology and soil fertility.

GDK 775 Project in environmental soil science 775
Academic organisation: Plant Production and Soil Science
Period of presentation: Year
Language of tuition: English **Credits:** 20
Module content:
Research project on a practical aspect of Environmental Soil Science.
Literature review, formulation of a problem statement, hypotheses and aims of the research, as well as the design and execution of a laboratory or field scale trial. Project to be written up in a specific scientific format suitable for publication with an oral and visual presentation on the research.

GDK 779 Basic soil science 779
Academic organisation: Plant Production and Soil Science
Contact time: 1 ppw 1 lpw
Period of presentation: Semester 1
Language of tuition: Double Medium **Credits:** 10
Module content:
This module is a basic introduction to Soil Science, designed for postgraduate students in Plant Science and Wildlife Management. The module will be presented over a 12-week period, including a one-day excursion.

GGY 701 Selected theme 701
Academic organisation: Geography, Geoinformatics and Meteorology
Contact time: 1 dpw 1 web-based period per week
Period of presentation: Year
Language of tuition: English **Credits:** 20
Module content:
(1) A self-study module selected in consultation with the head of the department from
  (a) themes not covered in existing options (e.g. environmental perception and behaviour; the spatial impact of decision making; environmental hazards and disasters, remote sensing), or

(b) educational subjects or themes; or
(2) an appropriate module from another subject.

GGY 702 Geography project 702
Academic organisation: Geography, Geoinformatics and Meteorology
Period of presentation: Year
Language of tuition: English **Credits:** 30
Module content:
An approved individual research project, carried out under the guidance of a lecturer. The project culminates in a research report in the format of a research paper. The student is expected to obtain the respective skills (theoretical and practical research techniques, data analysis, communication and computer skills) necessary for the research topic.

GGY 710 Evolution of geographical thought 710
Academic organisation: Geography, Geoinformatics and Meteorology
Contact time: 1 web-based period per week 1 lpw
Period of presentation: Semester 2
Language of tuition: English **Credits:** 20
Module content:
The module presents an overview of the contents and structure of modern geographical science, with particular reference to the development and impact of paradigms, the inter-dependence of systems within space and time, and to holistic concepts. The historical, philosophical and methodological development of geography and its interaction with other disciplines is also discussed, including the development of environmental concepts. Contemporary schools of thought and the role of specific subdisciplines are critically investigated.

GGY 718 Southern Africa geomorphology 718
Academic organisation: Geography, Geoinformatics and Meteorology
Contact time: 1 lpw 1 other per week
Period of presentation: Semester 2
Language of tuition: Double Medium **Credits:** 20
Module content:
This module involves investigating contemporary issues in southern African geo-morphology. Topics that may be studied include: geomorphic response to environmental change, soil erosion and conservation, weathering, slope processes and geo-morphological hazards.

GGY 780 Urban geography of Southern Africa 780
Academic organisation: Geography, Geoinformatics and Meteorology
Contact time: 1 dpw
Period of presentation: Year
Language of tuition: English **Credits:** 20
Module content:
Urbanisation, urban function and urban living in Southern Africa are the themes studied. Aspects under review include: the urbanisation process; urban morphology and function; the administrative structure and functioning of cities, and the quality of urban life.

GGY 789 Environmental change 789
Academic organisation: Geography, Geoinformatics and Meteorology
Contact time: 1 lpw 2 dpw
Period of presentation: Year

Language of tuition: English **Credits:** 20
Module content:
This module involves the study of the causes and consequences of environmental change from multidisciplinary perspectives. A focus of this module is human-environmental interaction. Past processes leading to environmental change will also be discussed. In any given year, one or more of the following will be investigated: principles of environmental change, causes and consequences of environmental change, climate change, global warming: causes and consequences, land use and land cover change, environmental change and infectious diseases, contemporary research into environmental change, and a field trip at the end of the module.

GGY 793 Geography of land reform 793
Academic organisation: Geography, Geoinformatics and Meteorology
Contact time: 1 lpw
Period of presentation: Year
Language of tuition: English **Credits:** 20
Module content:
The module aims to provide students with a basic understanding and knowledge of contemporary land reform issues against the background of international land reform experiences.
The module also touches on other rural development strategies and ultimately aims to enhance the student's ability to conceptualise and analyse policy.

GLY 702 Fluid-rock interaction 702
Academic organisation: Geology
Contact time: 5 lpw 5 ppw
Period of presentation: Year
Language of tuition: English **Credits:** 16
Module content:
Sources of fluids; mineral reactions; solubility and transport in fluids; metasomatism; case studies.

GLY 703 Basin analysis 703
Academic organisation: Geology
Contact time: 5 lpw 5 ppw
Period of presentation: Year
Language of tuition: English **Credits:** 16
Module content:
Principles of basin analysis; controls on sea level change; subsurface analytical methods; basin mapping methods; subsidence analysis (decompaction and sediment loading, subsidence curves); sequence stratigraphy; sedimentation systems in different basin types; Precambrian basins. Tectonic models for basin formation; fault systems; tectonics of intrusions.

GLY 704 Crustal evolution 704
Academic organisation: Geology
Contact time: 5 ppw 5 lpw
Period of presentation: Year
Language of tuition: English **Credits:** 16
Module content:
Precambrian crustal evolution. Precambrian plate tectonics. Precambrian evolution of the African plate (Eburnean, Kibaran and Pan-African events). Phanerozoic evolution to the

African plate; global examples of tectonics as a continental crustal source. Determination of deformational history of crustal rocks; determination of palaeostress conditions in ancient crustal rocks. Practical experience of structural analysis and determination of deformational history.

GLY 706 Mining methods 706
Academic organisation: Geology
Contact time: 5 ppw 5 lpw
Period of presentation: Year
Language of tuition: English **Credits:** 8
Module content:
Controlling legislation and infrastructural requirements. Mining methods: open cast and underground. Metallurgical treatment, metallurgical plants and waste disposal. Pollution, acid drainage and acid rain.

GLY 707 Mapping camp 707
Academic organisation: Geology
Period of presentation: Year
Language of tuition: English **Credits:** 8
Module content:
Mapping and analysis of a geologically complex area using different techniques.

GLY 710 Honours project 710
Academic organisation: Geology
Period of presentation: Year
Language of tuition: English **Credits:** 32
Module content:
Independent acquisition of geological field and/or laboratory data, treatment and interpretation thereof, and writing of an honours essay.

GLY 711 Igneous petrology and geochemistry 711
Academic organisation: Geology
Contact time: 5 ppw 1 dpw 1 spw 5 lpw
Period of presentation: Year
Language of tuition: English **Credits:** 16
Module content:
Interpretation and application of advanced petrogenetic tools: the Rb/Sr and Sm/Ndisotopic systems, quantitative interpretation of binary and ternary phase diagrams, assimilation-fractional crystallisation – partial melting. Abundance of elements in the crust, crust-forming models. Hydrous geochemistry. Recognition of geochemical anomalies. Analytical methods and the treatment of geochemical data.

GLY 712 Metamorphic petrology and geochemistry 712
Academic organisation: Geology
Contact time: 5 ppw 1 spw 1 dpw 5 lpw
Period of presentation: Year
Language of tuition: English **Credits:** 16
Module content:
Geothermometers and geobarometers, PT-t loops. Studies of major African and other mobile belts: Limpopo, Natal-Namaqua, Pan-African and Hoggar.

GLY 713 Economic geology 713
Academic organisation: Geology
Contact time: 1 dpw 5 ppw 1 spw 5 lpw
Period of presentation: Year
Language of tuition: English **Credits:** 16
Module content:
Basic remote sensing methods and their applications to geology; introduction to geophysics; basic geophysical and geochemical exploration techniques; exploration target generation – philosophies and methods; professional geological practice; the SAMREC and similar codes; geologists in the business environment.

GLY 714 Mineralogy 714
Academic organisation: Geology
Contact time: 5 ppw 5 lpw 1 dpw 1 spw
Period of presentation: Year
Language of tuition: English **Credits:** 16
Module content:
Ore microscopy-based identification of ore minerals (oxides, sulphides etc.), evaluation of ore textures (intergrowths, exsolutions, replacements) and assemblages for genetic and beneficiation evaluation with the use of phase diagrams. Compositional variation of ore minerals and their implications. Instrumental techniques for the identification and evaluation of ore minerals (electron microprobe, laser ablation ICPMS and QuemScan etc.).

GMA 705 Advanced remote sensing 705
Academic organisation: Geography, Geoinformatics and Meteorology
Contact time: 24 contact hours per semester
Period of presentation: Semester 2
Language of tuition: English **Credits:** 20
Module content:
The aim of the module is to provide knowledge and understanding of image analysis and information extraction methods in remote sensing. The emphasis is on equipping students with knowledge and skills necessary to process imagery to extract diverse biophysical and geospatial information. The module gives insight into the possibilities and limitations of the application of modern remote sensing/image acquisition systems for Earth and atmosphere research purposes at different levels of detail.

GTK 702 Seminar course 702
Academic organisation: Genetics
Contact time: 1 dpw 1 spw
Period of presentation: Year
Language of tuition: English **Credits:** 18
Module content:
Students are guided to collect relevant literature from disparate papers and to condense and collate this into a written seminar. Seminars are presented, along with formal article talks. Themes and articles in the Seminar course form part of the written examination upon completion of the module.

GTK 703 Research project 703
Academic organisation: Genetics
Period of presentation: Year
Language of tuition: English **Credits:** 70

Module content:
A mini-dissertation with well-defined limits is undertaken under the guidance of a lecturer. The students are allowed to choose from a number of projects from the different research programmes in the department. The module also has a strong theoretical component since emphasis is placed on writing and presenting a comprehensive literature review and project proposal. The project is concluded with a final report, presented in the format of a short manuscript, as well as a poster and an oral presentation.

GTK 704 Trends in genetics 704
Academic organisation: Genetics
Contact time: 4 dpw
Period of presentation: Year
Language of tuition: English **Credits:** 18
Module content:
Discussions and essays focusing on a selection of advanced topics, as well as recent advances in the field of genetics, with an emphasis on contextualising these developments within the broader framework of the Biosciences and its role in modern society. Ethical and philosophical issues in genetics are debated.

GTK 705 Research methods 705
Academic organisation: Genetics
Contact time: 5 lpw 5 ppw 10 dpw 5 web-based ppw
Period of presentation: Year 1
Language of tuition: English **Credits:** 36
Module content:
Students are guided through the methodology of research planning and data handling. They are offered hands-on experience in a range of advanced techniques employed in molecular research and analysis. Scientific writing and presentation skills, required for research in genetics, are also addressed.

GTX 713 Site investigation project 713
Academic organisation: Geology
Prerequisite: GLY 363/GLY 362
Contact time: 5 ppw
Period of presentation: Year
Language of tuition: English **Credits:** 48
Module content:
Field work which includes mapping, soil and rock description, joint surveys, borehole testing, water sampling, interpretation of laboratory test results and compilation of site investigation reports.
Larger projects of at least two months of fieldwork and report writing which involves surface and underground studies, mapping, drill core logging, discontinuity surveys, rock mass classification, stability analyses, interpretation of laboratory tests or pollution studies including water and/or soil sampling, interpretation of laboratory tests, development of a rehabilitation plan or groundwater model and compilation of a report.

GTX 714 Engineering geology of South Africa 714
Academic organisation: Geology
Prerequisite: SGM 311 or TDH
Contact time: 10 lpw
Period of presentation: Semester 2
Language of tuition: Both Afr and Eng **Credits:** 16

Module content:
Overview of site investigation phases; site investigation techniques; soil profiling and rock core description. Literature study and compilation of reports on the stratigraphy of South African rock types and the appropriate site investigation techniques to determine the engineering geological properties of rocks and soils within different stratigraphic units and climatic regions.

GTX 715 Environmental geochemistry 715
Academic organisation: Geology
Contact time: 1 spw
Period of presentation: Semester 2
Language of tuition: English **Credits:** 16
Module content:
Principles of low temperature geochemistry; geochemistry and origin of acid mine water; acid-mineral reactions; industrial effluents, remediation methods, waste disposal, environmental sampling and data analysis; geochemical modelling.

GTX 716 Environmental management and risk assessment 716
Academic organisation: Geology
Contact time: 1 spw
Period of presentation: Year
Language of tuition: English **Credits:** 16
Module content:
Principles of integrated environmental management; environmental impact assessment; environmental management systems (ISO 14000 series); water resource management; environmental legislation; site investigation guidelines; natural hazard risk assessment; seismicity; project management and professional business practice.

GTX 718 Hydrogeological modelling 718
Academic organisation: Geology
Contact time: 5 lpw 5 ppw
Period of presentation: Semester 2
Language of tuition: English **Credits:** 16
Module content:
Finite-difference methods; numerical solution of the flow and transport equations; spatial and temporal discretisation, stability criteria; development of conceptual models; introduction to PMWIN/Modflow.

GTX 719 Contaminant transport 719
Academic organisation: Geology
Prerequisite: GTX 715 or TDH
Contact time: 5 ppw
Period of presentation: Semester 2
Language of tuition: English **Credits:** 16
Module content:
Theory of contaminant transport in porous and fractured aquifiers, determination of transport parameters, boundary conditions, analytical solutions of 1-, 2- and 3-dimensional transport equations for porous aquifiers, analytical solutions for fractured aquifiers.

GTX 721 Construction materials 719
Academic organisation: Geology
Contact time: 5 ppw 1 dpw

Period of presentation: Year
Language of tuition: English **Credits:** 16
Module content:
Requirements for and use of concrete aggregates, road and dam construction materials; site investigation and site development methods; quality control.

GTX 722 Rock engineering 722
Academic organisation: Geology
Prerequisites: GLY 364
Contact time: 4 lpw 5 ppw 1 dpw
Period of presentation: Year
Language of tuition: English **Credits:** 16
Module content:
Mapping, description (core logging and discontinuity surveys) and classification of rock masses; engineering properties of rock masses including deformability, shear strength of discontinuities, in situ strength and permeability of rock masses; effects, theoretical derivation and practical measurements of in situ stresses.

GTX 723 Engineering applications 723
Academic organisation: Geology
Contact time: 1 dpw 4 lpw 5 ppw
Period of presentation: Year
Language of tuition: English **Credits:** 16
Module content:
The influence of geology on construction projects with specific reference to the requirements of dams, tunnels, slopes, waste disposal and urban development.

GTX 726 Rock and soil improvement 726
Academic organisation: Geology
Contact time: 10 lpw
Period of presentation: Year
Language of tuition: English **Credits:** 16
Module content:
Grouting materials and procedures; rock and soil anchors; rock and soil compaction; drainage methods.

HSC 783 Topics in horticulture 783
Academic organisation: Plant Production and Soil Science
Contact time: 1 spw 1 dpw
Period of presentation: Year
Language of tuition: English **Credits:** 15
Module content:
Studies of topics such as tree quality, water relations, fertiliser requirements, disease susceptibility, weed control and crop physiology.

HSC 788 Production systems (I): Tropical fruit production 788
Academic organisation: Plant Production and Soil Science
Contact time: 2 lpw 1 ppw
Period of presentation: Semester 2
Language of tuition: English **Credits:** 15
Module content:
Integrating the seasonal phenology of tropical fruit crops with management systems by

studying the botany, biochemistry and physiology, as well as the climate, soil, water, diseases, etc., aimed at maximizing yield, quality and profit.

HSC 789 Production systems (II): Temperate fruit production 789
Academic organisation: Plant Production and Soil Science
Contact time: 3 lpw 1 ppw
Period of presentation: Semester 2
Language of tuition: English **Credits:** 15
Module content:
Integrating the seasonal phenology of temperate fruit crops with management systems by studying the botany, biochemistry and physiology, as well as the climate, soil, water, diseases, etc., aimed at maximizing yield, quality and profit.

IAS 712 Liabilities 712
Academic organisation: Insurance and Actuarial Science
Prerequisite: IAS 361
Contact time: 2 lpw
Period of presentation: Year
Language of tuition: English **Credits:** 40
Module content:
Professionalism. Stakeholders and providers of benefits. Risks and uncertainties. Risk management and monitoring. Marketing. Life insurance products. General insurance products. Reinsurance. Regulation, regulatory regimes and the external environment. Capital management. Introduction to contract design. Valuation of benefits and the discount rate. Input validation. Valuation assumption setting. Provisioning. Product design: costing, pricing and funding. The relationship between assets and liabilities. Development of expected values. Reporting of actual results. Maintaining profitability. Asset management. Surplus management. Mergers, acquisitions, insolvency and closure. Options and guarantees.

KTV 700 Short-term insurance 700
Academic organisation: Insurance and Actuarial Science
Contact time: 1 dpw
Period of presentation: Year
Language of tuition: English **Credits:** 40
Module content:
Insurance companies, the actuarial control cycle, general insurance products, general insurance markets. The following aspects of the operation of a general insurance company: Actuarial investigations, outstanding claims reserves, reserves for IBNR and unexpired risks, reserving bases, premium rating, rating bases. Reinsurance products and applications, modelling for financial planning, investment, asset-liability modelling, accounting principles, interpreting accounts, claims analysis, other analyses.

LEK 702 Introduction to agribusiness management 702
Academic organisation: Agricultural Economics, Extension and Rural Development
Contact time: 1 lpw 1 ppw
Period of presentation: Semester 1
Language of tuition: English **Credits:** 20
Module content:
The module has been designed to meet the particular needs of those working in, or hoping to enter, the land-based and food industries. It explores management functions and economics of agricultural organisations and operations, including financial statement

analysis, efficient allocation of resources, value chains, enterprise combinations, and budget analysis.
The module also examines the nature and scope of the agribusiness industry including products and services, business types and organisation, and basic economics as well as risk management. A significant portion of the module is devoted to human relationships in management.

LEK 711 Advanced production economics 711
Academic organisation: Agricultural Economics, Extension and Rural Development
Prerequisite: EKT 713 and MIE 780
Contact time: 1 lpw 1 ppw
Period of presentation: Semester 2
Language of tuition: English **Credits:** 15
Module content:
Advanced production economics
(a) Primal approach: Structure of the production technology and properties, elasticity of substitution, homogeneity and returns to scale, separability, estimation of technology parameters and testing hypothesis about properties, functional forms.
(b) Normative supply analysis: Applications of linear programming to farm supply decisions.
(c) Dual approach: The profit function, the cost function, duality and technology structure, estimation and hypothesis testing.
(d) Positive supply analysis: Econometric specification of output supply and factor demand, restrictions from technology structure (homogeneity, etc.), aggregate supply analysis.
(e) Risk and uncertainty: Mean-variance analysis applications in agricultural production, stochastic dominance; MOTAD and quadratic programming.

LEK 712 Agricultural policy analysis 712
Academic organisation: Agricultural Economics, Extension and Rural Development
Contact time: 1 lpw 1 dpw
Period of presentation: Semester 2
Language of tuition: English **Credits:** 15
Module content:
Agricultural policy analysis. Reasons and effect of government intervention in agriculture. The economic theory of policy evaluation and analysis. Welfare considerations. Public choice theory and agricultural policy. Political Economy of Agricultural Policy. The role and applicability of quantitative agricultural policy analysis. Seminars.

LEK 713 Agricultural marketing 713
Academic organisation: Agricultural Economics, Extension and Rural Development
Contact time: 1 lpw
Period of presentation: Semester 2
Language of tuition: English **Credits:** 15
Module content:
Agricultural marketing. The nature, development and conceptualisation of marketing and marketing study; the marketing environment, nationally and internationally; the functional and institutional approaches to marketing study; price discovery and margins; dynamics of agricultural and food marketing channels; competition and concentration on horizontal and vertical level; conflict and power relationships in agricultural marketing; economics of food consumption, consumer behaviour and consumer action; food market segmentation; food quality and branding, price, product, promotional and distributional policy; marketing

analysis and planning. Global food marketing issues, contracting and changing global food retail patterns.

LEK 720 Agribusiness management 720
Academic organisation: Agricultural Economics, Extension and Rural Development
Contact time: 1 dpw 3 lpw
Period of presentation: Semester 2
Language of tuition: English **Credits:** 15
Module content:
Strategic management in agriculture. Dynamics of agricultural management. Entrepreneurship. Environmental scanning. Productivity measurement and improvement thereof by the organisation of manpower, capital and financial sources. Business growth. Formulation and implementation of competitive strategy. Corporate governance, strategic analysis and strategic choice, strategy implementation, balanced scorecard.

LEK 722 Agricultural finance and risk management 722
Academic organisation: Agricultural Economics, Extension and Rural Development
Contact time: 1 dpw 1 lpw 1 ppw
Period of presentation: Semester 2
Language of tuition: English **Credits:** 15
Module content:
Agricultural finance. Economic theory underlying agricultural finance and agricultural finance institutions. Supply and demand of agricultural financial services. Servicing the farm and the agricultural business firm. Agricultural finance within the broader financial market in South and Southern Africa. Risk assessment and management. Risk in agricultural finance and mitigation strategies.

LEK 723 Issues in agricultural and applied economics 723
Academic organisation: Agricultural Economics, Extension and Rural Development
Contact time: 1 dpw 1 spw 1 lpw
Period of presentation: Semester 2
Language of tuition: English **Credits:** 15
Module content:
Theoretical foundations for understanding issues in agricultural and applied economics: Review of relevant economic theories; Nature of agriculture in developing countries; why agricultural economics in developing countries?; Review of agricultural and rural development theories. Topical issues and emerging challenges at the frontiers of agricultural and rural development; Scanning of the environment and the literature for topical issues and emerging policy challenges; Gender in agricultural development; Appropriate agricultural development strategies, including creating and nurturing effective public-private partnerships; Readings and experiential learning activities on identified issues of focus and exploration in areas such as those listed above; Individual research on assigned optics. Developing special skills for understanding and appraising scholarly writings and policy documents.

LEK 725 Quantitative methods for agricultural economics 725
Academic organisation: Agricultural Economics, Extension and Rural Development
Prerequisite: STK 210 or equivalent
Contact time: 1 lpw 1 ppw
Period of presentation: Semester 1
Language of tuition: English **Credits:** 20

Module content:
Tools for mathematical economic analysis
(a) Calculus: functions, differentiation, exponentials, matrix algebra.
(b) Optimisation techniques and mathematical integration, growth functions and programming: constrained and unconstrained optima.
(c) Introduction to econometrics: probability and sampling distributions, hypothesis testing, linear transformations, linear regression, ordinary least squares in simple and multiple linear regressions.
(d) Research planning and methodology

LEK 780 Introduction to natural resource and environmental economics 780
Academic organisation: Agricultural Economics, Extension and Rural Development
Contact time: 1 spw 1 dpw 2 lpw
Period of presentation: Semester 2
Language of tuition: English **Credits:** 15
Module content:
Introduction to natural resource and environmental economics. This module reviews the origins and evolution of natural and environmental resource economics. It describes and studies the application of economic principles and analytical methods for sustainable development of renewable, non-renewable and environmental economics. Examine sources of inefficiency and causes as well as indicators of environmental degradation. The economics of pollution management: Concepts, policies and instruments. Sustainable management of natural and environmental resources. Introduction to Natural and Environmental Resource Policy. Economic valuation of natural and environmental resources.

LEK 782 International agricultural trade and policy 782
Academic organisation: Agricultural Economics, Extension and Rural Development
Contact time: 1 lpw 2 ppw
Period of presentation: Semester 1
Language of tuition: English **Credits:** 15
Module content:
WTO/GATT-1994 and agricultural-related Agreements and Understandings. Regionalism and trade blocks. International trade and economic development. South Africa's agricultural trade policy. Involvement in bilateral and plurilateral agreements. Application of international market analysis tools. International trade and tariff statistics, trade modelling, theory and familiarity in international and regional databases. The module covers the basic tools to understand what determines the flow of goods across countries, i.e. international trade, and applications to a number of topics of current interest, including the debate on globalisation, free trade agreements, the SA Current account and the medium run prospects for exchange rates.

LEK 783 Agricultural economics 783
Academic organisation: Agricultural Economics, Extension and Rural Development
Contact time: 1 dpw 1 lpw
Period of presentation: Semester 1
Language of tuition: English **Credits:** 20
Module content:
Research methodology and thesis design. Research in perspective. The research process. Formulating research problems, hypotheses and objectives. Developing a conceptual framework. Review of literature. Methods and procedures. Data collection,

processing and analysis. Developing a good research proposal. Writing and presenting a good research report.

LEK 784 Advanced rural finance 784
Academic organisation: Agricultural Economics, Extension and Rural Development
Contact time: 1 lpw
Period of presentation: Semester 1
Language of tuition: English **Credits:** 15
Module content:
Advanced rural finance. Economic theory underlying rural financial markets and institutions. Economic growth and financial services. Supply and demand of financial services in rural areas. Rural financial institutions and application to South and Southern Africa.

LEK 785 Agricultural project planning and appraisal 785
Academic organisation: Agricultural Economics, Extension and Rural Development
Contact time: 1 lpw 1 dpw
Period of presentation: Semester 1
Language of tuition: English **Credits:** 15
Module content:
a) Project planning and priority setting (project concept to rural socio-economic development, logical framework analysis, research priority setting methods, strategic planning, scenario planning).
b) Economic analysis of agricultural development projects through CBA (decision making in public and private sectors, financial, social and economic considerations; identification of Cs and Bs, valuation of Cs and Bs; project assessment criteria.
c) Monitoring, evaluation and impact assessment (process and program monitoring, M&E systems; causality, incrementality and the attribution problem; impacts assessment methodology.
d) Project management (scheduling, techniques for management, managing risk and uncertainty, monitoring performance
e) Welfare economics and political economy considerations (Pareto optimality, compensation tests, efficiency and distribution, politics of CBA, development projects vs. development policies, first vs. second best shadow prices, market failure)

LEW 700 Life assurance 700
Academic organisation: Insurance and Actuarial Science
Contact time: 2 lpw for 14 weeks
Period of presentation: Semester 2
Language of tuition: English **Credits:** 40
Module content:
The following aspects of the operation of a life insurance company are covered: General business environment; products offered; asset shares for life insurance contracts; with-profits surplus distribution; actuarial funding; models; setting of assumptions; aspects of products design; alterations to contracts; development and maintenance; investment; risk management procedures including reinsurance and underwriting; cost of guarantees; policy data checks; capital management and the actuarial control cycle. Modelling and monitoring policy cashflows for purposes of pricing, profit analysis, statutory valuation reserves and ongoing solvency.

LKM 750 Environmental biophysics 750
Academic organisation: Plant Production and Soil Science
Contact time: 2 lpw 1 ppw
Period of presentation: Semester 1
Language of tuition: English **Credits:** 15
Module content:
Environmental variables. Quantitative description and measurements of atmospheric environmental variables and water in organisms. Mass and energy fluxes. Quantitative description of energy fluxes in organisms' environments. Energy balances of animals and plant communities will be derived.

LMO 710 Linear models 710
Academic organisation: Statistics
Prerequisite: WST 311, WST 312, WST 321 and WST 322
Contact time: 1 lpw
Period of presentation: Semester 1
Language of tuition: English **Credits:** 20
Module content:
Projection matrices and sums of squares of linear sets. Estimation and the Gauss-Markov theorem. Generalised t- and F- tests.

LMO 720 Linear models 720
Academic organisation: Statistics
Prerequisite: LMO 710
Contact time: 1 lpw
Period of presentation: Semester 2
Language of tuition: English **Credits:** 20
Module content:
The singular normal distribution. Distributions of quadratic forms. The general linear model. Multiple comparison. Analysis of covariance. Generalised linear models. Analysis of categorical data.

MCP 751 Research methods 751
Academic organisation: Microbiology and Plant Pathology
Contact time: 7 lpw 5ppw
Period of presentation: Year 1
Language of tuition: English **Credits:** 36
Module content:
The module provides students with planning, data handling, writing, and presentation skills required for microbiological research. In addition, students are provided with hands-on experience in the advanced techniques utilised in research and analysis. Ethnical and philosophical issues in the broader field of microbiology and plant pathology are also addressed.

MCP 752 Seminar course 752
Academic organisation: Microbiology and Plant Pathology
Contact time: 3 dpw 2 spw
Period of presentation: Year 1
Language of tuition: English **Credits:** 18
Module content:
Students are guided to collect relevant literature from disparate papers in the broader field of Microbiology and Plant Pathology and to condense and collate this into a written seminar, which is also presented verbally.

MCP 753 Trends in Microbiology 753
Academic organisation: Microbiology and Plant Pathology
Contact time: 3 dpw 2 spw
Period of presentation: Year 1
Language of tuition: English **Credits:** 18
Module content:
Discussions and essays focusing on recent advances in the broader field of microbiology and plant pathology, as well as contextualising these developments within the broader framework of the biosciences and its role in modern society.

MCP 754 Research project and literature study 754
Academic organisation: Microbiology and Plant Pathology
Period of presentation: Year 1
Language of tuition: English **Credits:** 70
Module content:
The module includes both practical and theoretical components. In addition to an individual research project with well-defined limits that is undertaken under the guidance of a lecturer, the module also acquaint the student with the theoretical aspects relevant to a specific research topic. The research project is thus preceded by the presentation of an in-depth review of the relevant literature, and the project is concluded with a progress report, presented in the format of a short publication and an oral presentation

MEK 780 Macroeconomics 780
Academic organisation: Economics
Prerequisite: EKN 310 and EKN 320
Contact time: 1 spw
Period of presentation: Semester 1
Language of tuition: English **Credits:** 20
Module content:
The study of the relationships that determine the operation and performance of the economy as a whole. Following a review of some basic concepts, the element of time (e.g. growth and business cycles) and the international economy (open-economy macroeconomics) are analysed. This is followed by several topical issues; amongst them the convergence hypothesis, international crises and the phenomenon of globalisation.

MET 710 Multivariate techniques 710
Academic organisation: Statistics
Prerequisite: STK 310 and STK 320
Contact time: 1 lpw
Period of presentation: Semester 2
Language of tuition: English **Credits:** 20
Module content:
Matrix methods in statistics, vector addition and multiplication, determinants, vector space and rank, inverse of a matrix, trace of a matrix, characteristic roots, orthogonal vectors.
Multivariate distributions: expected values and covariance matrices, moment generating functions.
The multivariate normal distribution: definition, distribution of quadratic forms and independence.
The linear model: the statistical model, least squares estimators.
Generalized t- and F- tests.
Linear regression: simple linear regression, multiple linear regression.
Analysis of variance.

MET 720 Multivariate techniques 720
Academic organisation: Statistics
Prerequisite: MET 710
Contact time: 1 lpw
Period of presentation: Semester 1
Language of tuition: English **Credits:** 20
Module content:
Estimation: methods of moments and maximum likelihood. Cramer-Rao inequality, mean squared error, loss and risk functions, Bayes estimators. Sufficient statistics, completeness, the exponential class. Tests of statistical hypothesis: power function, critical region and Neyman-Pearson lemma.

MFK 700 Medical physics 700
Academic organisation: Physics
Period of presentation: Year
Language of tuition: Afrikaans **Credits:** 20

MIE 780 Microeconomics 780
Academic organisation: Economics
Prerequisite: EKN 310, EKN 320 and WEK 780
Period of presentation: Semester 1
Language of tuition: English **Credits:** 20
Module content:
Demand and supply theory. The derivation of demand and supply curves by means of mathematical utility and production functions forms part of the module.
Production factor markets, both perfect and imperfect, and imperfect product markets are also included.

MLB 721 Molecular and cellular biology 721
Academic organisation: Microbiology and Plant Pathology
Contact time: 2 dpw
Period of presentation: Semester 2
Language of tuition: English **Credits:** 18
Module content:
Principles and applications of recombinant DNA, and other novel molecular and genomics technologies, to address questions in the biological sciences and/or biotechnology. Strong emphasis is placed on the principles of research planning, including identifying suitable research objectives, formulating a research strategy and understanding the relevance and feasibility of research.
The module is assessed by means of a research project proposal, conceived and formulated by each student. The proposal must focus on the use of molecular technologies in addressing realistic questions in biology and/or biotechnology. There is also an oral defense of the project proposal.
This module is jointly presented in the departments of Biochemistry, Genetics and Microbiology and Plant Pathology.

MVA 710 Multivariate analysis 710
Academic organisation: Statistics
Prerequisite: WST 311, WST 312, WST 321and WST 322
Contact time: 1 lpw
Period of presentation: Semester 1
Language of tuition: English **Credits:** 20

Module content:
Matrix algebra. Multivariate distributions. Samples from multivariate normal populations. The Wishart distribution. Hotelling's T^2 statistic. Inferences about mean vectors.

MVA 720 Multivariate analysis 720
Academic organisation: Statistics
Prerequisite: MVA 710
Contact time: 1 lpw
Period of presentation: Semester 2
Language of tuition: English **Credits:** 20
Module content:
The matrix normal distribution, correlation structures and inference of covariance matrices. Principal component analysis, factor analysis, discriminant analysis.

NLB 780 Animal population dynamics 780
Academic organisation: Animal and Wildlife Sciences
Contact time: 1 lpw 1 ppw
Period of presentation: Semester 1
Language of tuition: Double Medium **Credits:** 5
Module content:
Selected wildlife management philosophies, principles and concepts, followed by aspects of the population dynamics of animals applicable to wildlife management. The principles and application of the following are discussed amongst others: General population characteristics, the density concept, mortality, natality, life tables, population growth, harvesting quotas, population regulation, population structure, dispersal, dispersion, aggregation, isolation and territoriality, competition and predator-prey relationships.

NLB 781 Wildlife management principles and techniques 781
Academic organisation: Animal and Wildlife Sciences
Contact time: 1 lpw 1 ppw
Period of presentation: Semester 1
Language of tuition: Double Medium **Credits:** 5
Module content:
The most important techniques applicable to wildlife management and wildlife research are discussed. The principles, applications and restrictions of the following are discussed amongst others: wildlife counts, age determination, age and sex ratios, translocation of animals, chemical immobilisation, mechanical capture techniques, transport of wildlife, land-use, predator control and predator-prey studies.

NLB 782 Wildlife nutrition 782
Academic organisation: Animal and Wildlife Sciences
Contact time: 1 lpw 1 ppw
Period of presentation: Semester 2
Language of tuition: Double Medium **Credits:** 10
Module content:
The digestive functioning of selected ruminant and non-ruminant herbivores. Physiology and fermentation are discussed, followed by the role of secondary chemicals and toxins in plants, measures against toxic plants and symptoms of poisoning. Energy balance, mineral shortages, supplemental feeding and the nutritional requirements of unweaned animals are related to sicknesses and diseases associated with poor nutrition.

NLB 783 Parasites, diseases and the capture of wildlife animals 783
Academic organisation: Animal and Wildlife Sciences
Period of presentation: Semester 1
Language of tuition: Double Medium **Credits:** 10
Module content:
Parasites, diseases and capture of wild animals. An overview of veterinary aspects with reference to important parasites and diseases of wild animals. The capture of wildlife and the stress-related consequences of the capture of wild animals. The module content includes a discussion of all the different chemicals used to immobilise wild animals, darting, and handling of wild animals under sedation. The internal and external parasites, most important contagious wildlife diseases and the prevention of capture related diseases are discussed.

NLB 784 Mammal science 784
Academic organisation: Animal and Wildlife Sciences
Contact time: 6 lpw 1 lpw
Period of presentation: Semester 2
Language of tuition: Double Medium **Credits:** 5
Module content:
An overview of the general characteristics of small mammals. An in-depth review of the southern African small mamal fauna and an overview of collecting and study techniques.

NLB 785 Seminar 785
Academic organisation: Animal and Wildlife Sciences
Period of presentation: Semester 1
Language of tuition: Double Medium **Credits:** 5
Module content:
A seminar on an ecological or wildlife management topic.

NLB 795 Research project 795
Academic organisation: Animal and Wildlife Sciences
Period of presentation: Year
Language of tuition: Double Medium **Credits:** 50
Module content:
A research protocol, field work and project report based on an ecological or wildlife management topic.

NPN 780 Research project 780
Academic organisation: Insurance and Actuarial Science
Period of presentation: Year
Language of tuition: Both Afr and Eng **Credits:** 20
Module content:
The research project is compulsory. A detailed project proposal should be submitted to the head of department by a prescribed date for approval, as described in the depart-mental document in this regard.

PAN 780 Production analysis 780
Academic organisation: Agricultural Economics, Extension and Rural Development
Contact time: 3 lpw 2 ppw
Period of presentation: Semester 1
Language of tuition: Double Medium **Credits:** 20
Price and production function analysis. Input-output, input-input and product-product

relationships; profit maximization; the production process through time, economies of size; decision making in agriculture under risk and uncertain circumstances; linear programming.

PFS 700 Production physiology 700
Academic organisation: Animal and Wildlife Sciences
Contact time: 3 lpw
Period of presentation: Year
Language of tuition: Double Medium **Credits:** 22
Module content:
Specialised study of physiological and anatomical factors that influence growth, development, production and product quality. Stress and intensification effects on product quality. Animal science pharmacology. (Theoretical components include VKF 411 and VSX 420.)

PGW 701 Plant production 701
Academic organisation: Plant Production and Soil Science
Contact time: 1 lpw 2 dpw
Period of presentation: Year
Language of tuition: English **Credits:** 30
Module content:
Plant production systems. Integration of ecological, agronomic, edaphic, climatological and economical knowledge in production systems in Agronomy/Horticulture/Pasture Science which emphasise optimum sustainable utilisation of natural resources. Case studies.

PGW 702 Scientific communication 702
Academic organisation: Plant Production and Soil Science
Contact time: 3 spw 1 lpw
Period of presentation: Year
Language of tuition: English **Credits:** 30
Module content:
Principles of the scientific process. Literature accessing and article assessment. Manuscript preparation and presentation of seminars. Use of visual aids.

PGW 704 Research methodology 704
Academic organisation: Plant Production and Soil Science
Contact time: 1 ppw
Period of presentation: Semester 1
Language of tuition: English **Credits:** 15
Module content:
Basic experimental designs. Measurements and control over experimental error. Factorial experiments and interactions. Analysis of variance (ANOVA) and data interpretation.

PHY 701 Mathematical methods 701
Academic organisation: Physics
Contact time: 6 lpw
Period of presentation: Semester 1
Language of tuition: English **Credits:** 15
Module content:
The purpose of this module is two-fold: (1) To refresh and systematize your knowledge of mathematics (sequences, series, vector calculus, functions of many variables etc.); (2) To

give you working knowledge of mathematical methods that were not (or not sufficiently) covered in the underground modules, such as Fourier series and transforms; Ordinary and partial differential equations; Abstract vector spaces; Operators and their eigenvectors; Complex analysis; Calculus of variations; Integral equations; Group theory; Probability and statistics; Numerical methods.

PHY 702 Classical mechanics 702
Academic organisation: Physics
Contact time: 6 lpw
Period of presentation: Semester 1
Language of tuition: English **Credits:** 15
Module content:
Lagrangian dynamics: Lagrange's equations, d'Alembert's principle, energy, applications, the tangent bundle, action, symmetry, conservation, Noether's Theorem, linear oscillations, normal modes.
Hamiltonian dynamics: Hamilton's equations, symplectic notation, phase space, Liouville's Theorem, Poisson brackets, canonical transformations, generating functions, the Hamilton-Jacobi equation. Elementary Lagrangian field theory.

PHY 703 Quantum mechanics 703
Academic organisation: Physics
Contact time: 4 lpw
Period of presentation: Semester 1
Language of tuition: English **Credits:** 15
Module content:
Origins of quantum mechanics; mathematical tools; postulates and quantization; conservation laws; one-dimensional problems; linear harmonic oscillator; three-dimensional problems; angular momentum; hydrogen atom; addition of angular momenta; spin; approximate methods (WKB, variational approach, time-independent perturbations); time-dependent perturbations; scattering; partial wave scattering; identical particles; Hartree-Fock approach; many-body problems and quantum statistics; second quantisation; relativistic equations.

PHY 704 Statistical physics 704
Academic organisation: Physics
Contact time: 4 lpw
Period of presentation: Semester 1
Language of tuition: English **Credits:** 15
Module content:
Thermodynamic behaviour of an ideal Bose gas: Bose-Einstein functions, the virial expansion, the Riemann zeta-function, Bose-Einstein condensation. Phonons: the field of sound waves, inertial density of the sound field, elementary excitations in liquid helium II. Ideal Fermi systems: thermodynamic behaviour of an ideal Fermi gas, Fermi-Dirac functions and their relation to Bose-Einstein functions, the virial expansion, the Fermi energy, asymptotic expansions at low temperature, magnetic behaviour of an ideal Fermi gas (Pauli paramagnetism, Landau diamagnetism). Quantised fields: free bosonic quantum fields, interacting quantum fields, interacting Hamiltonian, interactions in terms of creation and annihilation operators, imperfect Bose gasses at low temperature, fermionic quantum fields, interacting theory, the ground state of an imperfect Fermi gas. Phase transition in the Ising model: mean field theory, critical exponents.

PHY 705 Electrodynamics 705
Academic organisation: Physics
Contact time: 6 lpw
Period of presentation: Semester 2
Language of tuition: English **Credits:** 15
Module content:
Conservation laws in electrodynamics; electromagnetic waves in vacuum, dielectrics, conductors and wave guides; potentials and fields, guage transformations, Liénard-Wiechert potentials; electric and magnetic dipole radiation, radiation by a point charge; relativistic electrodynamics.

PHY 706 Project and seminar 706
Academic organisation: Physics
Period of presentation: Year
Language of tuition: English **Credits:** 15
Module content:
A theoretical or an experimental project can be done. The project must be approved by the head of department. The project must be summarised in the form of an open seminar.

PHY 708 Many body physics 708
Academic organisation: Physics
Contact time: 6 lpw
Period of presentation: Semester 1
Language of tuition: English **Credits:** 15
Module content:
Second quantisation. Coherent states. Single particle behaviour. Hartree-Fock – perturbation – linearisation of operators. Quasi-particles, effective mass and applications: atom physics, electron gas, one dimensional delta function. Collective behaviour. Tamm-Dancoff approximation: linearisation. Time dependent Hartree-Fock. Random phase approximation.
Applications: giant dipole resonance, screening in an electron gas, correlation energy in an electron gas, plasma oscillations, zero sound. Canonical transformation – Cooper pairs, BSC theory. Thomas-Fermi theory. Density functional theory. Superconduction. Ginzberg-Landau theory. Zero field finite temperature BCS.

PHY 710 Numerical physics 710
Academic organisation: Physics
Contact time: 2 lpw
Period of presentation: Semester 1
Language of tuition: English **Credits:** 15
Module content:
Numerical nature of physical problems such as atomic structure, electric fields, harmonic oscillators (classic and quantum mechanics), heat conduction, hydrodynamics, Ising model, molecular vibrations, order and chaos, potential scattering, Schrödinger equation, wave equation.

PHY 711 Solid state physics 711
Academic organisation: Physics
Contact time: 6 lpw
Period of presentation: Semester 1
Language of tuition: English **Credits:** 15

Module content:
Electronic band structure, vibration properties of solids, electronic properties of defects, electric transport, optical properties, quantum confinement.

PHY 712 Quantum optics 712
Academic organisation: Physics
Contact time: 4 lpw
Period of presentation: Semester 1
Language of tuition: English **Credits:** 10
Module content:
Coherent states of free and forced oscillators. Semi-classical electrodynamics (including time dependent perturbations and stimulated transitions). Mode composition of the electromagnetic field. Properties of laser light. Resonators and modes. Laser types (ruby, Nd-YAG, Carbondioxide, He-Ne, excimer and GaAs).

PHY 713 Electronic materials 713
Academic organisation: Physics
Contact time: 6 lpw
Period of presentation: Semester 1
Language of tuition: English **Credits:** 15
Module content:
Structure, electrical and optical properties of semiconductors; semiconductor metal contacts; Ohmic and Schottky contacts; influence of impurities and defects on properties of the contacts; quantum well semiconductor structures.

PHY 714 Analytical physics 714
Academic organisation: Physics
Contact time: 4 lpw
Period of presentation: Semester 1
Language of tuition: English **Credits:** 15
Module content:
Review of surface analytical techniques, surface structure determinations, surface topography techniques, theory of contrast in electron microscopy; electron microscopic surface and interface techniques; scanning tunnelling microscopy; electrical and electro-optical characterisation of semiconductors; determination of defects and impurities in semiconductors; propagation of laser rays; photoluminescence.

PHY 715 Nuclear solid state physics 715
Academic organisation: Physics
Contact time: 4 lpw
Period of presentation: Semester 1
Language of tuition: English **Credits:** 10
Module content:
Mössbauer effect; positron annihilation; perturbed angular correlations; neutron scattering; RBS; channeling; nuclear reaction analyses.

PHY 716 Group theory 716
Academic organisation: Physics
Contact time: 4 lpw
Period of presentation: Semester 1
Language of tuition: English **Credits:** 10

Module content:
Introduction to group theory needed in physics. Thirty-two crystallografic point groups; selected groups; full rotation groups; applications such as classification of spectral terms; selection rules; Clebs-Gordon coefficients.

PHY 717 Quantum field theory 717
Academic organisation: Physics
Contact time: 4 lpw
Period of presentation: Semester 2
Language of tuition: English **Credits:** 10
Module content:
Special relativity. Representation of transformations in quantum physics. Canonical quantisation of free scalar fields. Interactions, scattering and the reduction formula. Path integrals in quantum mechanics; the harmonic oscillator. Free fields. Interacting fields, perturbation theory and Feynman diagrams. Scattering amplitudes and the Feynman rules. Renormalisation: Dimensional analysis, the exact propagator, the exact three point vertex, higher order corrections and perturbation theory to all orders. Symmetry: Continuous symmetries and conserved currents, discrete symmetries. The renormalisation group: Infrared divergences, different renormalisation schemes and asymptotic freeness, the renormalisation group. Spontaneous symmetry breaking: A discrete example, a continous example, the Goldstone boson.

PHY 718 Experimental physics 718
Academic organisation: Physics
Contact time: 2 ppw
Period of presentation: Semester 1
Language of tuition: English **Credits:** 15
Module content:
Five different experiments. These experiments will be determined by the head of department.

PHY 719 Nuclear physics 719
Academic organisation: Physics
Prerequisites: Admission only with permission of Head of Department, Physics
Contact time: 4 lpw
Period of presentation: Semester 2
Language of tuition: English **Credits:** 10
Module content:
Quarks, nucleons, isobaric invariance, NN-interaction, two-nucleon system, deuteron, elements of scattering theory, NN-scattering, few-body nuclear systems, general properties of medium and heavy nuclei, nuclear models, radioactivity, nuclear reactions, α-, β-, and γ-decays, nuclear fission, nuclear fusion, nuclear astrophysics.

PHY 781 Foundations of physics 781
Academic organisation: Physics
Contact time: 2 lpw
Period of presentation: Semester 1
Language of tuition: English **Credits:** 10
Module content:
Conceptual basis of physics: The nature of Laws of Physics, basic concepts and misconceptions. Nature of physics, its history, nature of evidence, paradigms, current views and controversies of the nature of the physics enterprise. Indigenous knowledge in

the field of physics, and alternative world views, physics in society. Limits and abuses of the results of Modern Physics.

PHY 782 Current trends in physics 782
Academic organisation: Physics
Prerequisite: Completion of core components of the BScHons
Contact time: 2 lpw
Period of presentation: Semester 1
Language of tuition: English **Credits:** 30
Module content:
A chosen field of physics that is linked to the research specialisations of groups within the Physics department. Approaches and trends in research advances in new topics in physics. The module follows a format of guided advanced readings, seminars and discussion sessions.

PNP 720 Parametric and nonparametric stochastic processes 720
Academic organisation: Statistics
Prerequisite: WST 312, VMT 710
Contact time: 1 lpw
Period of presentation: Semester 2
Language of tuition: English **Credits:** 20
Module content:
Part A: Parametric Stochastic processes:
Queueing processes: M/M/1; M/M/S; M/G/1 queues and variants; limiting distribution of the queue length and waiting times. Queuing networks. Some stochastic inventory and storage processes.
Part B: Nonparametric stochastic processes:
Power and asymptotic power of distribution-free procedures: Theory and simulation. Asymptotic relative efficiency: Linear rank tests: Definition, properties and applications.

PNS 700 Pensions 700
Academic organisation: Insurance and Actuarial Science
Period of presentation: Year
Language of tuition: English **Credits:** 40
Module content:
Providers of pension and related benefits. Needs of beneficiaries and sponsors. State sponsored vs. private sector sponsors. Presentation and reporting of benefits and contributions. Professional guidance. General and detailed benefit design, risk and uncertainty in pension funds. Methods of financing, pension fund investment and investment matching. The actuarial control cycle in the pension fund industry. Asset valuation, asset-liability modelling. Funding methods. Valuation, valuation data, basis assumption setting and analysis of experience. Discontinuance, options and guarantees, pension fund risk benefits.

PPR 712 Plant production: Herbicides and control 712
Academic organisation: Plant Production and Soil Science
Contact time: 2 lpw 1 dpw
Period of presentation: Semester 2
Language of tuition: English **Credits:** 15
Module content:
Weeds and their importance in Southern Africa. Properties and uses of herbicides. Herbicides in soils and their mode of action in plants.

PPR 713 Agroforestry 713
Academic organisation: Plant Production and Soil Science
Contact time: 1 ppw 1 dpw 1 lpw
Period of presentation: Year
Language of tuition: Both Afr and Eng **Credits:** 15
Module content:
Agro-ecological zones (climate and soil); trees for fruit, fodder, fuel and/or timber; inter-cropping or alley cropping with grains, vegetables or pastures; management (including aspects such as nursery production, establishment, fertilisation, pest control) and utilisation/marketing.

PPT 761 Sanitary and phytosanitary issues 761
Academic organisation: Microbiology and Plant Pathology
Contact time: Block: 6 weeks per semester, 3 dpw
Period of presentation: Semester 2
Language of tuition: English **Credits:** 20
Module content:
The three pillars of Risk Analysis i.e. Risk Assessment, Risk Communication and Risk Management are covered in this module. Risk Assessment (RA) is important in determining Fair Trade principles and scientifically sound import regulations and requirements. Theory and application of RA in terms of market access and international trade requirements are covered. Qualitative and quantitative approaches to the determination of probabilities are discussed. Focus falls on handling probabilities and reduction of risk in the export of locally produced fresh commodities. Sanitary and Phytosanitory (SPS) issues as possible Technical Barriers to trade in fresh produce are dealt with. Background to international standards for SPS includes pest risk analysis to set up import regulations, export certification systems, quality assurance, food safety and guidelines for surveillance. The International Plant Protection Convention and CODEX are discussed. Harmonization of trade protocols, production practices, standards, grades and quality assurance and its implications in the SADC region are also covered in the module.

PPT 780 Introductory plant pathology 780
Academic organisation: Microbiology and Plant Pathology
Contact time: 1 ppw 2 lpw
Period of presentation: Semester 1
Language of tuition: Both Afr and Eng **Credits:** 20
Module content:
General principles in plant pathology. Aspects of mycology, bacteriology, virology and plant microbe interaction. Basic principles of disease control, scripts on selected topics and reports on field visits to nurseries, packhouses and farms. Seminars on selected topics in Plant Pathology.

PPT 781 Plant pathology: Disease control 781
Academic organisation: Microbiology and Plant Pathology
Contact time: 1 ppw 2 lpw
Period of presentation: Semester 2
Language of tuition: English **Credits:** 20
Module content:
Principles of disease control. Chemical, physical and biological control and principles of plant quarantine. Modern chemotherapy, properties and applications of fungicides and discussions on special topics pertaining to disease control.

RAL 780 Regression analysis 780
Academic organisation: Statistics
Prerequisite: STK 310 and STK 320
Contact time: 1 lpw 1 web-based period per week
Period of presentation: Semester 1
Language of tuition: English **Credits:** 20
Module content:
Simple and multiple regression models. Residual analysis. Diagnostics for leverage, influence and multicolinearity. Indicator variables. Regression approach to analysis of variance. Weighted least squares. Nonlinear regression. Ridge regression. Logistic regression.
Theory is combined with practical work. Specific attention is given to matrix algebra.

SFT 720 Sampling techniques 720
Academic organisation: Statistics
Prerequisite: BScHons: WST 311, WST 312, WST 321, WST 322; BComHons: STK 310, 320
Contact time: 1 lpw
Period of presentation: Semester 1
Language of tuition: English **Credits:** 20
Module content:
Simple random sampling. Estimation of proportions and sample sizes. Stratified random sampling. Ratio and regression estimators. Systematic and cluster sampling. Complex survey methodology. Handling of nonresponse.

SIZ 711 Insect diversity: Economic and ecological implications 711
Academic organisation: Zoology and Entomology
Contact time: 2 dpw 1 ppw
Period of presentation: Year
Language of tuition: English **Credits:** 20
Module content:
Insect classification and the structuring of diversity; economically and ecologically important insect taxa: apterygote and exopterygote insects – silverfish, mayflies, dragonflies, cockroaches, mantids, termites, earwigs, locusts, stick insects, lice, bugs and thrips; endopterygote insects – lacewings, beetles, flies, fleas, butterflies moths, bees, wasps and ants.

SIZ 724 Integrated pest management 724
Academic organisation: Zoology and Entomology
Contact time: 2 dpw
Period of presentation: Year
Language of tuition: English **Credits:** 20
Module content:
The origin of insect pests; their host crops; threshold values; pest status; insect pest management; biological, cultural and chemical control of insects; insect herbivores as weed biocontrol agents; insects as vectors in human and animal disease; non-vector problem insects; control methods in veterinary entomology; conservation, agriculture and human health; beneficial insects; beekeeping; silk production; insects as human and animal food; insects and ecosystems; chemicals and the environment; insects and eco-tourism.

SPC 780 Statistical process control 780
Academic organisation: Statistics
Prerequisite: BScHons: WST 311, WST 312, WST 321, WST 322; BComHons in Statistics: STK 310, 320
Contact time: 1 lpw
Period of presentation: Semester 2
Language of tuition: English **Credits:** 20
Module content:
Quality control and improvement. Shewhart, cumulative sum (CUSUM) and exponentially weighted moving average (EWMA) control charts. Determining process and measurement systems capability. Parametric and nonparametric (distribution-free) control charts. Constructing control charts using Microsoft Excel.

STK 795 Research report 795
Academic organisation: Statistics
Prerequisite: STK 310, STK 320, RAL 780 and MET 710
Period of presentation: Year
Language of tuition: English **Credits:** 20

SVS 710 Statistical forecasting 710
Academic organisation: Statistics
Prerequisite: STK 310 and STK 320
Contact time: 1 lpw
Period of presentation: Semester 1
Language of tuition: English **Credits:** 20
Module content:
Simple random sampling. Estimation of proportions and sample sizes. Stratified random sampling. Ratio and regression estimators. Systematic and cluster sampling. Complex survey methodology. Handling of nonresponse.

TLR 700 Animal breeding and genetics 700
Academic organisation: Animal and Wildlife Sciences
Contact time: 1 dpw 1 ppw 2 lpw
Period of presentation: Year
Language of tuition: Double Medium **Credits:** 24
Module content:
Qualitative characteristics. Calculation of population criteria and the interpretation in the industry. Specific problems with relation to the selection and breeding of cattle, small stock, pigs and poultry. The application of genetic theory in practice with relation to hereditability of quantitative characteristics. (Theoretical components include TLR 410 and TLR 420.)

TRA 720 Analysis of time series 720
Academic organisation: Statistics
Prerequisite: STK 310 and STK 320
Contact time: 1 lpw
Period of presentation: Semester 2
Language of tuition: English **Credits:** 20
Module content:
In this module certain basic topics relating to discrete, equally spaced stationary and non-stationary time series are introduced as well as the identification, estimation and testing of time series models and forecasting. Theoretical results are compared to corresponding

results obtained from computer simulated time series.

UNI 763 Internet GIS 763
Academic organisation: Geography, Geoinformatics and Meteorology
Contact time: 1 web-based period per week 1 lpw
Period of presentation: Semester 2
Language of tuition: English **Credits:** 20
Module content:
This module aims to explore the Internet as a platform for accessing and delivering geospatial data and services. Students will be exposed to the theory and practice of technologies and technology approaches that make Internet GIS a reality. From the basic building blocks of Internet GIS, to advanced Spatial Data Infrastructure concepts, this module covers current and emerging issues in bringing geospatial data and processes to the wider world. Students will be required to reflect on the implications of using such technologies. A significant portion of the module will involve 'hands-on' work in designing and building Internet GIS applications and accessing Internet-based data and services. This module also includes consideration of a number of case studies within different problem domains. Students should leave the module with an understanding of the building blocks that make Internet GIS possible and be able to consider what are good practices in the development of Internet GIS applications and services.

UNI 766 Spatial statistics and geodesy 766
Academic organisation: Geography, Geoinformatics and Meteorology
Contact time: 1 dpw 1 web-based period per week
Period of presentation: Semester 2
Language of tuition: English **Credits:** 20
Module content:
Principles of least squares in statistics, spatial least squares regression, surface inter-polation using least squares and coordinate transformations.
Topics in Geodesy: Space-based measurement systems, sea level measurements, determination of the geoid, earth axis orientation determination and earth dynamics.

UNI 787 GIS logistics and data acquisition 787
Academic organisation: Geography, Geoinformatics and Meteorology
Contact time: 1 dpw 1 web-based period per week
Period of presentation: Year
Language of tuition: English **Credits:** 20
Module content:
The aim of this module is the application of logistical processes to improve the GIS unit's response to satisfy a customer's need. The focus will be on supply chains, supply chain management with special emphasis on data acquisition and quality. Supply chains have a minimum of three entities, namely suppliers, the manufacturer and customers. The manufacturer in the context of Geographic Information Systems (GIS) is the GIS unit. The GIS unit plans the supply chain, sources material, including data, from suppliers; produces a GIS product; delivers the product to the customer; and deals with the return of faulty products.

UNI 791 GIS professional practice 791
Academic organisation: Geography, Geoinformatics and Meteorology
Contact time: 1 web-based period per week 1 dpw
Period of presentation: Year
Language of tuition: English **Credits:** 20

Module content:
The module introduces the organisational aspects of GIS (how it fits into an organisation, critical success factors and people issues), GIS project management and GIS professional issues (GIS profession, professional registration, business practice, and ethics).

UNI 792 Geographic information systems project 792
Academic organisation: Geography, Geoinformatics and Meteorology
Contact time: 1 web-based period per week 1 dpw
Period of presentation: Year
Language of tuition: English **Credits:** 30
Module content:
This module provides the student with the opportunity to build a GIS application. Project stages include: problem and hypothesis generation, project methodology, data needs analysis, database design, data analysis and communication of final information products.

VDS 713 Recipe development and standardisation 713
Academic organisation: Consumer Science
Contact time: 3 lpw 1 ppw
Period of presentation: Semester 1
Language of tuition: Both Afr and Eng **Credits:** 30
Module content:
Recipe development process. Development of appropriate recipes and food products for a given situation. Standardisation of recipes. Food styling and food photography.

VDS 723 Food consumerism and product advice 723
Academic organisation: Consumer Science
Contact time: 3 lpw
Period of presentation: Semester 2
Language of tuition: Both Afr and Eng **Credits:** 15
Module content:
Factors influencing food consumption, consumer behaviour and food choice. Food product advice. Consumer advice, marketing of food products, consumer education.

VGE 703 Animal nutrition 703
Academic organisation: Animal and Wildlife Sciences
Contact time: 5 lpw 1 dpw 1 ppw
Period of presentation: Year
Language of tuition: Double Medium **Credits:** 50
Module content:
Advanced study with specialisation in the neutrino of monogastric species for example poultry, dogs and pigs. Advanced study of foregut and hindgut digestive processes and flow dynamics. Manipulation of digestion, end-product metabolism, ad libitum and controlled feed intake. Energy, protein, mineral and vitamin requirements and standards for beef and diary cattle, small stock and horses. Appropriate ration formulation. The study embodies lectures, seminars, practical assignments and a research project with the results reported in a research paper. (Theoretical components include VGE 411, VGE 421 and VGE 423.)

VKU 700 Animal science 700
Academic organisation: Animal and Wildlife Sciences
Period of presentation: Year

Language of tuition: Double Medium **Credits:** 70
Module content:
The study of animal-environment and genotype-environment interactions and the impact on natural resources. Adaptational mechanisms of breeds and species. The formulation of optimal farming systems with respect to adaption. The determination of biological outputs and the classification of animal breeds and species in terms of biological traits. A study of specific topics by way of literature, seminars, discussions and research assignments. Each student does a research project and compiles a research paper. Research and study assignments are executed taking the academic needs of the candidates into consideration. (Theoretical components GVK 420, KVK 420, PVK 420, VKD 410, VKU 411, VKU 412 and WKE 420.)

VMT 710 Distribution-free methods 710
Academic organisation: Statistics
Prerequisite: WST 311, WST 312, WST 321 and WST 322
Contact time: 1 lpw
Period of presentation: Semester 1
Language of tuition: English **Credits:** 20
Module content:
Equal in distribution technique. Counting and ranking statistics. Introduction to one and two sample U-statistics. Permutation and distribution-free rank-like statistics. Multi-sample distribution-free tests, rank correlation and regression. Some nonparametric bootstrap and smoothing methods.

VVW 720 Advanced nutrition and food sciences 720
Academic organisation: Food Science
Contact time: 12 discussion classes
Period of presentation: Semester 2
Language of tuition: English **Credits:** 20
Module content:
Discussion classes in advanced level nutrition and food sciences. Problem solving and literature discussion.

VVW 763 Research project 763
Academic organisation: Food Science
Period of presentation: Year
Language of tuition: English **Credits:** 45
Module content:
A short research project on an approved topic in Nutrition and Food Sciences is planned, executed and presented in the form of a written report.

VVW 765 Micronutrient malnutrition 765
Academic organisation: Food Science
Contact time: 1 dpw
Period of presentation: Semester 2
Language of tuition: English **Credits:** 20
Module content:
Introduction to malnutrition in sub-Saharan Africa. Selected micronutrients (i.e. vitamin A, Fe, iodine, Zn): Their role as micronutrients and their significance in health, deficiency disorders and prevention thereof. Conceptual framework for understanding micronutrient deficiencies. Nutritional epidemiology. Micronutrients in nutritional support of individuals with HIV/aids.

WDE 701 Range management in wildlife systems 701
Academic organisation: Plant Production and Soil Science
Contact time: 5 dpw
Period of presentation: Semester 1
Language of tuition: English **Credits:** 10
Module content:
Range evaluation and utilisation with the emphasis on aspects important in wildlife production, and integrated wildlife/livestock production systems.

WDE 750 Environmental resource assessment and management 750
Academic organisation: Plant Production and Soil Science
Contact time: 3 lpw 1 ppw
Period of presentation: Semester 1
Language of tuition: English **Credits:** 20
Module content:
Determining resource potential of land on the basis of botanical composition, vegetation cover, animal grazing and browsing potential, water quality, soil quality, chemical, physical and biological soil degradation, soil erosion and other important environmental processes. These are essential for integrated agricultural land use practices. Evaluation of grasses and other vegetation types in terms of environmental adaptation, acceptability and adaptability to a sustainable utilisation system and the management requirements of an integrated and adaptive management system.

WDE 781 Rangeland management 781
Academic organisation: Plant Production and Soil Science
Contact time: 1 lpw
Period of presentation: Year
Language of tuition: Both Afr and Eng **Credits:** 15
Module content:
The development of rangeland management strategies integrating ecological and physiological principles with economic and sociological constraints to achieve desired objectives whilst ensuring the conservation, and where necessary, the recuperation of natural resources.

WDE 782 Pasture science 782
Academic organisation: Plant Production and Soil Science
Contact time: 2 lpw
Period of presentation: Year
Language of tuition: Both Afr and Eng **Credits:** 15
Module content:
The identification of adapted pasture and fodder species (including grasses, legumes, fodder trees and drought tolerant crops) for different agro-ecological areas. The establishment, fertilisation and irrigation requirements of different pastures. The management requirements when utilised as green grazing, standing hay or conserved feed.

WDE 783 Integrated plant and animal production 783
Academic organisation: Plant Production and Soil Science
Contact time: 2 lpw 1 ppw
Period of presentation: Year
Language of tuition: Both Afr and Eng **Credits:** 15
Module content:
The role of crop rotations and ley crops in marginal cropping conditions to ensure

sustained production. The integration of pastures and silvicultural/ horticultural crops (eg. Agroforestry) to produce timber, firewood, fruits/nuts and livestock products. Provision of feed requirements for both commercial and communal livestock enterprizes by combining livestock requirements and feed supply in a process of economic optimisation and emphasizing the importance of records and responses in the process of implementation.

WKD 703 Seasonal and climate modelling 703
Academic organisation: Geography, Geoinformatics and Meteorology
Contact time: 2 lpw
Period of presentation: Semester 1 or Semester 2
Language of tuition: English **Credits:** 20
Module content:
Introduction to the philosophy of scientific research. Hypothesis testing. Reporting of scientific research. Fundamentals of seasonal forecasting. The El Nino Southern Oscillation. Empirical Orthogonal Functions; Canonical Correlation Analysis. Empirical forecast models. General circulation models. Fully coupled and two-tiered modelling systems. Post-processing. Significance testing. Understanding seasonal forecasts. Projections of decadal and multidecadal climate anomalies.

WKD 704 Numerical modelling: Applications 704
Academic organisation: Geography, Geoinformatics and Meteorology
Contact time: 2 lpw
Period of presentation: Semester 1
Language of tuition: English **Credits:** 20
Module content:
Short-term numerical modelling. Initial atmospheric state. Observation network. Data assimilation. Initialisation. Parameterisation. Numerical models. Post-processing. Long-term numerical modelling: ensemble methods; probability forecasting. Evaluation of deterministic and categorical forecasts. Mesoscale numerical modelling. Initial and boundary conditions. Dynamical equations. Physical equations and introduction to the parameterisation of the boundary layer. Cumulus convection; heat and radiation.

WKD 705 Numerical modelling: Basic concepts 705
Academic organisation: Geography, Geoinformatics and Meteorology
Contact time: 2 lpw
Period of presentation: Semester 1 or Semester 2
Language of tuition: English **Credits:** 20
Module content:
Numerical weather predictions. Equations and coordinates. Scale and energy conservation. Equation sets for operational systems. Grid point methods: finite difference; time differencing; the advection equation; the gravity wave equation; economical schemes. Function expansion methods: spectral modelling; finite element modelling. Boundary conditions.

WKD 706 Dynamic meteorology 706
Academic organisation: Geography, Geoinformatics and Meteorology
Contact time: 2 lpw
Period of presentation: Semester 1 or Semester 2
Language of tuition: English **Credits:** 20
Module content:
Atmospheric oscillations: linear perturbation theory; baroclinic instability; two-layer model; energetics of baroclinic waves; fronts and frontogenesis; symmetric instability. Zonal

averaged circulation. Angular momentum budget. Introduction to structure and circulation to the middle atmosphere. Potential vorticity and stratospheric intrusions. Rossby waves and Rossby wave breaking. Dynamics of the Southern Annular Mode.

WKD 708 Cloud microphysics 708
Academic organisation: Geography, Geoinformatics and Meteorology
Contact time: 2 lpw
Period of presentation: Semester 1 or Semester 2
Language of tuition: English **Credits:** 20
Module content:
Thermodynamics of the atmosphere. Tropospheric aerosols and weather. Observed properties of clouds. Droplet formation and growth. Ice processes. Weather modification. Remote sensing and microphysical parameters. Parameterising cloud microphysical properties.

WKD 719 Boundary layer meteorology 719
Academic organisation: Geography, Geoinformatics and Meteorology
Contact time: 2 lpw
Period of presentation: Semester 1 or Semester 2
Language of tuition: English **Credits:** 20
Module content:
Introduction to, and the importance of the boundary layer. Structure of the boundary layer. Transfer of heat (molecular and turbulent). Impacts of the turbulent nature of the boundary layer on the dynamics of atmospheric motions. Closure and boundary layer parameterisation. Applications to air pollution dispersion.

WKD 731 Overview of tropical and mid-latitude meteorology 731
Academic organisation: Geography, Geoinformatics and Meteorology
Contact time: 6 lpw
Period of presentation: Semester 1 or Semester 2
Language of tuition: English **Credits:** 20
Module content:
An overview of the weather and climate of the tropics and the mid-latitudes. Air masses. Instability and cloud formation. Weather systems of the tropics and mid-latitudes. Analysis of weather systems by utilising remote sensed data. Applications of the quasi-geostrophic system of diagnostic equations. The thickness tendency equation and self development and limiting processes.

WKD 732 Convective weather 732
Academic organisation: Geography, Geoinformatics and Meteorology
Contact time: 6 lpw
Period of presentation: Semester 1 or Semester 2
Language of tuition: English **Credits:** 20
Module content:
Introduction to meoscale meteorology and surface mesoscale features. Convection and severe convection; Lightning. Forecasting of thunderstorms. Flooding and flash-flooding. Convective storm analysis with radar and satellite. Application of different channels available from satellites and radar to identify different atmospheric phenomena. Identifying different storm types and nowcasting.

WKD 761 Basic concepts of remote sensing 761
Academic organisation: Geography, Geoinformatics and Meteorology

Contact time: 2 lpw
Period of presentation: Semester 1 or Semester 2
Language of tuition: English **Credits:** 20
Module content:
The influence of the atmosphere on the propagation of electromagnetic waves. The influence of attenuation on observations. Doppler effect. Precipitation measurements with radar and satellite. Introduction to remote sensing sensors, instruments and platforms. Overview of meteorological and non-meteorological satellite systems. Application of remotely sensed data: general and meteorological applications.

WKD 763 Research project 763
Academic organisation: Geography, Geoinformatics and Meteorology
Contact time: 1 lpw 2 dpw
Period of presentation: Year
Language of tuition: English **Credits:** 40
Module content:
Identification of an appropriate research project. Compilation of a research proposal. Literature survey. Acquisition and manipulation of information. Introduction to innovative strategy and research management. Preparation of a research report (or paper). Presentation of research findings.

WKD 781 Cloud dynamics 781
Academic organisation: Geography, Geoinformatics and Meteorology
Contact time: 2 lpw
Period of presentation: Semester 1 or Semester 2
Language of tuition: Afrikaans **Credits:** 20
Module content:
Scaling and interpretation of equations of motion for mesoscale processes. The role of stability and other trigger actions on initial cloud formation and the evolution of clouds. Shallow and deep convective processes. Gravity and Lee wave effects. Tropical and mid-latitude cloud generation processes and characteristics. Cloud splitting. Cumulus convective schemes in numerical models. Parameterisation of radiation and heat in atmospheric models.

WST 795 Research report: Mathematical statistics 795
Academic organisation: Statistics
Prerequisite: WST 311, WST 312, WST 321 and WST 322
Period of presentation: Semester 1 and Semester 2
Language of tuition: English **Credits:** 20
Module content:
Refer to the document: Criteria for the research management process and the assessment of the honours essays, available on the web: www.up.ac.za under the Department of Statistics: Postgraduate study.

WTW 710 Functional analysis 710
Academic organisation: Mathematics and Applied Mathematics
Prerequisite: Real analysis on third-year level
Contact time: 1 lpw
Period of presentation: Semester 1
Language of tuition: English **Credits:** 20
Module content:
An introduction to the basic mathematical objects of linear functional analysis will be

presented. These include metric spaces, Hilbert spaces and Banach spaces. Subspaces, linear operators and functionals will be discussed in detail. The fundamental theorems for normed spaces: The Hahn-Banach theorem, Banach-Steinhaus theorem, open mapping theorem and closed graph theorem. Hilbert space theory: Riesz' theorem, the basics of projections and orthonormal sets.

WTW 712 Modern portfolio theory 712
Academic organisation: Mathematics and Applied Mathematics
Contact time: 1 lpw
Period of presentation: Semester 2
Language of tuition: English **Credits:** 20
Module content:
An introduction to Markowitz portfolio theory and the capital asset pricing model. Analysis of the deficiencies in these methods. Sensitivity-based risk management. Standard methods for Value-at-Risk calculations. RiskMetrics, delta-normal methods, Monte Carlo simulations, back and stress testing.

WTW 731 Algebra 731
Academic organisation: Mathematics and Applied Mathematics
Prerequisite: Algebra on third-year level
Contact time: 1 lpw
Period of presentation: Semester 1
Language of tuition: English **Credits:** 20
Module content:
The following topics will be covered: Galois theory and solving equations by radicals, introduction to the theory of R-modules, direct sums and products, projectivity and injectivity, finitely generated modules over Euclidean domains, primary factorisation, applications to Jordan and rational canonical forms of matrices.

WTW 732 Mathematical models of financial engineering 732
Academic organisation: Mathematics and Applied Mathematics
Contact time: 1 lpw
Period of presentation: Semester 1
Language of tuition: English **Credits:** 20
Module content:
Introduction to markets and instruments. Futures and options trading strategies, exotic options, arbitrage relationships, binomial option pricing method, mean variance hedging, volatility and the Greeks, volatility smiles, Black-Scholes PDE and solutions, derivative disasters.

WTW 733 Numerical analysis 733
Academic organisation: Mathematics and Applied Mathematics
Contact time: 1 lpw
Period of presentation: Semester 1
Language of tuition: English **Credits:** 20
Module content:
An analysis as well as an implementation (including computer programs) of methods are covered. Numerical linear algebra: Direct and iterative methods for linear systems and matrix eigenvalue problems: Iterative methods for nonlinear systems of equations. Finite difference method for partial differential equations: Linear elliptic, parabolic, hyperbolic and eigenvalue problems. Introduction to nonlinear problems. Numerical stability, error estimates and convergence are dealt with.

WTW 734 Measure theory and probability 734
Academic organisation: Mathematics and Applied Mathematics
Prerequisite: Real analysis on third-year level
Contact time: 1 lpw
Period of presentation: Semester 1
Language of tuition: English **Credits:** 20
Module content:
Measure and integration theory: The Caratheodory extension procedure for measures defined on a ring, measurable functions, integration with respect to a measure on a σ-ring, in particular the Lebesgue integral, convergence theorems and Fubini's theorem.
Probability theory: Measure theoretic modelling, random variables, expectation values and independence, the Borel-Cantelli lemmas, the law of large numbers. L^1-theory, L^2-theory and the geometry of Hilbert space, Fourier series and the Fourier transform as an operator on L^2, applications of Fourier analysis to random walks, the central limit theorem.

WTW 762 Mathematical models of financial engineering 762
Academic organisation: Mathematics and Applied Mathematics
Prerequisite: WTW 732
Contact time: 1 lpw
Period of presentation: Semester 2
Language of tuition: English **Credits:** 20
Module content:
Exotic options, arbitrage relationships, Black-Scholes PDE and solutions, hedging and the Miller-Modigliani theory, static hedging, numerical methods, interest rate derivatives, BDT model, Vasicek and Hull-White models, complete markets, stochastic differential equations, equivalent Martingale measures.

WTW 763 Finite element method 763
Academic organisation: Mathematics and Applied Mathematics
Prerequisite: WTW 733 is strongly recommended
Contact time: 1 lpw
Period of presentation: Semester 2
Language of tuition: English **Credits:** 20
Module content:
An analysis as well as an implementation (including computer programs) of methods is covered. Introduction to the theory of Sobolev spaces. Variational and weak formulation of elliptic, parabolic, hyperbolic and eigenvalue problems. Finite element approximation of problems in variational form, interpolation theory in Sobolev spaces, convergence and error estimates.

WTW 764 Stochastic calculus 764
Academic organisation: Mathematics and Applied Mathematics
Prerequisite: WTW 734
Contact time: 1 lpw
Period of presentation: Semester 2
Language of tuition: English **Credits:** 20
Module content:
Mathematical modelling of Random walk. Conditional expectation and Martingales. Brownian motion and other Lévy processes. Stochastic integration. Ito's Lemma. Stochastic differential equations. Application to finance.

WTW 772 Mathematical methods and models 772
Academic organisation: Mathematics and Applied Mathematics
Prerequisite: Real analysis on third-year level
Contact time: 1 lpw
Period of presentation: Semester 1
Language of tuition: English **Credits:** 20
Module content:
This module aims at using advanced undergraduate mathematics and rigorously applying mathematical methods to concrete problems in various areas of natural science and engineering. The module will be taught by several lecturers from UP, industry and public sector. The content of the module may vary from year to year. The list of areas from which topics to be covered will be selected, includes: Systems of differential equations; dynamical systems; discrete structures; Fourier analysis; methods of optimisation; numerical methods; mathematical models in biology, finance, physics, etc.

WTW 776 Partial differential equations of mathematical physics 776
Academic organisation: Mathematics and Applied Mathematics
Prerequisite: WTW 710 and WTW 734
Contact time: 1 lpw
Period of presentation: Semester 2
Language of tuition: English **Credits:** 20
Module content:
Field-theoretic and material models of mathematical physics. Distributions and the Friedrichs-Sobolev spaces. Energy methods and Hilbert spaces, weak solutions – existence and uniqueness. Eigenvalue problems and eigenfunction expansions. The regularity theorems for elliptic forms (without proofs) and their applications. Weak solutions for the heat/diffusion and related equations. Weak solutions for wave propagation problems written as symmetric-hyperbolic systems.

WTW 787 Continuum Mechanics 787
Academic organisation: Mathematics and Applied Mathematics
Contact time: 1 lpw
Period of presentation: Semester 2
Language of tuition: English **Credits:** 20
Module content:
Analysis of spatial versus material description of motion. Conservation laws. Derivation of stress tensors. Analysis of finite strain and rate of deformation tensors. Stress and strain invariants. Energy. Linear and nonlinear constitutive equations. Applications to boundary value problems in elasticity and fluid mechanics.

WTW 790 Topology 790
Academic organisation: Mathematics and Applied Mathematics
Prerequisite: Real analysis on third-year level
Contact time: 1 lpw
Period of presentation: Semester 2
Language of tuition: English **Credits:** 20
Module content:
General topology: Concepts such as convergence, compactness, connectedness, separation axioms and continuity are introduced in topological spaces. Their basic properties are treated. Important topologies like the product topology and the quotient topology are discussed. Algebraic topology: Homotopy, the fundamental group, covering spaces, homotopy type.

WTW 792 Project 792
Academic organisation: Mathematics and Applied Mathematics
Period of presentation: Year
Language of tuition: English **Credits:** 20
Module content:
Refer to Department.

WTW 795 Essay 795
Academic organisation: Mathematics and Applied Mathematics
Period of presentation: Year
Language of tuition: English **Credits:** 20
Module content:
Refer to Department.

ZEN 701 Research project 701
Academic organisation: Zoology and Entomology
Period of presentation: Semester 1 and Semester 2
Language of tuition: English **Credits:** 80
Module content:
Research project

ZEN 702 Research methods 702
Academic organisation: Zoology and Entomology
Contact time: 1 ppw 4 dpw
Period of presentation: Semester 1
Language of tuition: English **Credits:** 16
Module content:
Basic skills in philosophy of science; research planning; experimental design; data handling; mathematical techniques for biologists; scientific writing; scientific public speaking.

ZEN 703 Systematics, evolution and biogeography 703
Academic organisation: Zoology and Entomology
Period of presentation: Semester 1
Language of tuition: English **Credits:** 16
Module content:
The object of this module is to introduce students to several contemporary problem areas in systematics, evolutionary theory and biogeography, and to use this as a basis for exploring current approaches and methods in systematics.

ZEN 704 Ecological and evolutionary physiology 704
Academic organisation: Zoology and Entomology
Contact time: 4 dpw
Period of presentation: Semester 1
Language of tuition: English **Credits:** 16
Module content:
Physiological processes underlying ecological and behavioural patterns. Three general topics will be covered: (i) the physiological basis and significance of biological rhythms, and the influence of environmental variables such as day length, (ii) the physiological mechanisms that permit animals to feed on specialised diets such as diluted nectar, and (iii) the suite of research tools that provide analyses of naturally-occurring stable isotope ratios provided to physiologists and ecologists.

ZEN 705 Ecology 705
Academic organisation: Zoology and Entomology
Contact time: 4 dpw
Period of presentation: Semester 1
Language of tuition: English **Credits:** 16
Module content:
The module focuses on forces that drive population and community patterns and processes across temporal and spatial scales. Attention is given to the scientific application of ecological and macro-ecological principles that relate to short- and long-term population and community responses to environmental change. Group discussions based on current literature provide opportunities to apply theoretical principles to problem solving.

ZEN 707 Integrated pest management in Africa 707
Academic organisation: Zoology and Entomology
Contact time: 1 dpw
Period of presentation: Semester 2
Language of tuition: English **Credits:** 16
Module content:
Pest outbreaks and the practice of integrated pest management using different control methods; philosophy of IPM; socio-economic implications; politics and legislation; pest models; decision tools and techniques.

ZEN 710 Mammal ecology 710
Academic organisation: Zoology and Entomology
Contact time: 4 dpw
Period of presentation: Semester 2
Language of tuition: English **Credits:** 16
Module content:
Contemporary issues in mammal ecology; the focus will be on current understanding at individual, population, community and ecosystem levels.

ZEN 712 Behavioural ecology 712
Academic organisation: Zoology and Entomology
Contact time: 4 dpw
Period of presentation: Semester 2
Language of tuition: English **Credits:** 16
Module content:
The use of ecological and evolutionary processes to explain the occurrence and adaptive significance of behaviour patterns. Empirical, comparative analyses relating behaviour to environment will be addressed, including the use of behavioural processes to predict ecological patterns.

ZEN 713 Scientific communication 713
Academic organisation: Zoology and Entomology
Period of presentation: Semester 1 and Semester 2
Language of tuition: English **Credits:** 16
Module content:
An essay, two oral presentations, prescribed reading and an oral exam.

ZEN 782 Insect-plant interactions 782
Academic organisation: Zoology and Entomology
Contact time: 4 dpw

Period of presentation: Semester 2
Language of tuition: English **Credits:** 16
Module content:
An overview of the complex world of insect-plant interactions. Insects and plants have co-occurred and co-evolved on this planet for at least 400 million years, and in many systems insects are the primary consumers of plant tissue. The diverse strategies and counter-strategies that have evolved at the interface between herbivory and plant defences will be examined, using case studies and applying unifying theory wherever possible.

ZEN 783 Global climate change and biodiversity 783
Academic organisation: Zoology and Entomology
Contact time: 3 dpw 1 lpw
Period of presentation: Semester 1
Language of tuition: English **Credits:** 16
Module content:
The module aims to provide students with an understanding of global climate change and its impact on the conservation of biodiversity.

AGR 800 Agronomy 800
Academic organisation: Plant Production and Soil Science
Contact time: 2 lpw
Period of presentation: Year
Language of tuition: Both Afr and Eng **Credits:** 80
Module content:
Any module and/or assignment(s) at the advanced level chosen in consultation with the head of department.

AGR 801 Advanced coursework 801
Academic organisation: Plant Production and Soil Science
Contact time: 1 dpw
Period of presentation: Year
Language of tuition: Both Afr and Eng **Credits:** 120
Module content:
Any module and/or assignment(s) at the advanced level chosen in consultation with the head of department.

AGR 890 Dissertation: Agronomy 890
Academic organisation: Plant Production and Soil Science
Period of presentation: Year
Language of tuition: Both Afr and Eng **Credits:** 160
Module content:
Each candidate must write a dissertation on his/her research project in Agronomy and at least prepare a concept research paper for publication in a peer-reviewed scientific journal.

AGR 891 Mini-dissertation: Agronomy 891
Academic organisation: Plant Production and Soil Science
Period of presentation: Year
Language of tuition: Both Afr and Eng **Credits:** 120
Module content:
Each candidate must write a mini-dissertation on his/her research project in Agronomy

and at least prepare a concept research paper for publication in a peer-reviewed scientific journal.

AGV 800 Agrarian extension 800
Academic organisation: Agricultural Economics, Extension and Rural Development
Period of presentation: Year
Language of tuition: Both Afr and Eng **Credits:** 20

AGV 801 Report: Extension 801
Academic organisation: Agricultural Economics, Extension and Rural Development
Period of presentation: Year
Language of tuition: Both Afr and Eng **Credits:** 40

AGV 890 Dissertation: Agrarian extension 890
Academic organisation: Agricultural Economics, Extension and Rural Development
Period of presentation: Year
Language of tuition: Both Afr and Eng Credits: 180

AGV 891 Mini-dissertation: Extension 891
Academic organisation: Agricultural Economics, Extension and Rural Development
Period of presentation: Year
Language of tuition: Both Afr and Eng Credits: 120

APZ 801 Advanced course: Animal production 801
Academic organisation: Animal and Wildlife Sciences
Period of presentation: Year
Language of tuition: English Credits: 40

APZ 802 Research Report: Animal Production 802
Academic organisation: Animal and Wildlife Sciences
Period of presentation: Year
Language of tuition: English Credits: 200

AQM 811 Boundary layer meteorology 811
Academic organisation: Geography, Geoinformatics and Meteorology
Contact time: 1 lpw
Period of presentation: Year
Language of tuition: English **Credits:** 20
Module content:
Introduction to global circulation and South African weather and climate. Mathematical functions and atmospheric balance laws. Stability and mixing heights. The atmospheric boundary layer over urban and rural areas. Turbulence. Earth's energy budget. Transfer and exchange of energy. Introduction to atmospheric and chemical dispersion modelling. Practical modelling of air pollution: Box models, Gausian puff or plume models, stochastic models, trajectory models.

AQM 812 Atmospheric chemistry 812
Academic organisation: Geography, Geoinformatics and Meteorology
Contact time: 1 lpw
Period of presentation: Year
Language of tuition: English **Credits:** 20
Module content:
The history of atmospheric pollution. Cycles of matter and atmospheric transformations.

Gaseous inorganic pollutants. Gas phase organic pollutants. Particulates. The chemistry of atmospheric environmental problems, including acid rain; global warming; ozone depletion; persistant organic pollutants; and photochemical smog. Atmospheric monitoring: sampling methods; sampling strategies; and analytical techniques.

AQM 813 Atmospheric thermodynamics 813
Academic organisation: Geography, Geoinformatics and Meteorology
Contact time: 1 lpw
Period of presentation: Year
Language of tuition: English **Credits:** 20
Module content:
Gas laws. Virtual temperature. The hydrostatic and hypsometric equations. Dry adiabatic processes. The first law of thermodynamics. Latent heat. Stabilities and instabilities. Dry adiabatic temperature lapse rate. Potential temperature. Inversion layers. Atmospheric moisture and saturated-adiabatic processes. Vapour pressure. Saturation and condensation. Dew and frost point. Relative humidity. Saturated adiabatic temperature lapse rate. Cloud and rain formation. The second law of thermodynamics.

AQM 814 Air pollution: Society and environment 814
Academic organisation: Geography, Geoinformatics and Meteorology
Contact time: 1 lpw
Period of presentation: Year
Language of tuition: English **Credits:** 20
Module content:
International air quality criteria and standards. Ambient air quality and meteorological monitoring. Domestic pollution. Household fuel burning. Vehicle emissions. Toxicology and physiology. Industrial pollution. Emissions inventory and report sources. Air pollution and biomass. Air pollution control. Identification of alert air quality thresholds and associate information reporting, investigation and mitigation requirements. Renewable energy. Air pollution and climate. Practical experience.

AWM 890 Dissertation: Meteorology 890
Academic organisation: Geography, Geoinformatics and Meteorology
Period of presentation: Year
Language of tuition: Both Afr and Eng **Credits:** 240

BCM 801 Trends in biochemical research 801
Academic organisation: Biochemistry
Contact time: 1 dpw
Period of presentation: Year
Language of tuition: English **Credits:** 18
Module content:
Study and discussion of topical research results from recent scientific publications.

BCM 802 Literature seminar 802
Academic organisation: Biochemistry
Contact time: 1 spw
Period of presentation: Semester 1
Language of tuition: English **Credits:** 9
Module content:
Preparation and presentation of reviews of biochemical literature.

BCM 890 Project and dissertation 890
Academic organisation: Biochemistry
Period of presentation: Year
Language of tuition: English **Credits:** 213

BIF 801 Bioinformatics seminar 801
Academic organisation: Biochemistry
Contact time: 1 spw
Period of presentation: Year
Language of tuition: English **Credits:** 18
Module content:
A literature seminar in the field of bioinformatics compiled from recent scientific publications.

BIF 802 Trends in bioinformatics 802
Academic organisation: Biochemistry
Contact time: 1 dpw
Period of presentation: Year
Language of tuition: English **Credits:** 9
Module content:
Study and discussion of topical research results from recent scientific publications.

BIF 803 Bioinformatics research project and report 803
Academic organisation: Biochemistry
Period of presentation: Year
Language of tuition: English **Credits:** 213

BOT 802 Plant systematics 802
Academic organisation: Plant Science
Period of presentation: Year
Language of tuition: English **Credits:** 30
Module content:
Plant variation and evolution; theory and practice of plant classification; concept of categories in the taxonomic hierarchy; sources and handling of taxonomic data; taxonomic collections (herbaria and curating of collections); the process of plant identification; code of nomenclature; taxonomic publication.

BOT 890 Dissertation: Plant science 890
Academic organisation: Plant Science
Period of presentation: Year
Language of tuition: Both Afr and Eng **Credits:** 240

CHM 890 Dissertation: Chemistry 890
Academic organisation: Chemistry
Period of presentation: Year
Language of tuition: Both Afr and Eng **Credits:** 200

EGF 890 Dissertation: Exploration geophysics 890
Academic organisation: Geology
Period of presentation: Year
Language of tuition: Both Afr and Eng **Credits:** 240

EGF 900 Exploration geophysics 900
Academic organisation: Geology
Period of presentation: Year
Language of tuition: Both Afr and Eng **Credits:** 1

EGF 990 Thesis: Exploration geophysics 990
Academic organisation: Geology
Period of presentation: Year
Language of tuition: Both Afr and Eng **Credits:** 480

ENS 811 Environment and development 811
Academic organisation: Geography, Geoinformatics and Meteorology
Period of presentation: Year
Language of tuition: English **Credits:** 20
Module content:
Interrelationships between societal and environmental dynamics. Social structure, culture, politics, education, migration, production, urbanisation, demographics and social institutions impact upon the environment, environmental change impacts on social aspects. Analysis of complex interrelationships between society and the environment, societal-environmental linkages and multiplier effects.

ENS 822 Strategic environmental management 822
Academic organisation: Geography, Geoinformatics and Meteorology
Contact time: 2 dpw
Period of presentation: Year
Language of tuition: English **Credits:** 20
Module content:
Strategic environmental planning: introduction, objectives and principles; levels; South African overview; guidelines: national and international; strategy and management; structure, strategy and agency; South African guidelines; diagnostic tools; RESP analysis; strategic resource planning; applications, implementation and control; development and policy implementation; South African environmental policy; evaluation frameworks; portfolio analysis; competitive forces; alliances; business benefits; intangibles, survival and catalytic contributions; South African legislation and regulations.

ENS 823 Environment and land reform 823
Academic organisation: Geography, Geoinformatics and Meteorology
Period of presentation: Year
Language of tuition: English **Credits:** 20
Module content:
The need and purpose of land reform in South Africa and its contribution towards sustainable social-environmental interaction. An overview of the global variety of land tenure systems, and tenure reform programmes in other countries. Overview of previous systems of land tenure in South Africa. Land reform policy in South Africa: restitution, redistribution, and tenure reform. Critical assessment of progress in terms of land reform objectives. Evaluation of the contribution of the South African land reform programme towards creating sustainable environments.

ENS 824 Social modelling and assessment 824
Academic organisation: Geography, Geoinformatics and Meteorology
Period of presentation: Year
Language of tuition: English **Credits:** 20

Module content:
In this module students will be introduced to the various methods of modelling and assessing social impacts. Specific emphasis will be placed upon modelling societal-economic-environmental interactions, formulating stochastic and dynamic models of population-development-environment interactions, conducting research to determine possible impacts of environmental changes on communities and performing social impact surveys. Students will be introduced to both quantitative as well as qualitative methods of conducting social impacts assessments.

ENT 890 Dissertation: Entomology 890
Academic organisation: Zoology and Entomology
Period of presentation: Year
Language of tuition: English **Credits:** 240

ENV 810 Environmental paradigms 810
Academic organisation: Zoology and Entomology
Contact time: 5 dpw
Period of presentation: Semester 1
Language of tuition: English **Credits:** 20
Module content:
Environmental philosophy and ethics, environmental ecology, environment, society and development, environmental economics, environmental management, critical resources management: water utilisation, air quality control, land-use planning: soil characteristics, biodiversity planning, critical resource management: determinism vs co-evolutionary environmental frameworks, research methodology and practice.

ENV 816 Environmental law 816
Academic organisation: Zoology and Entomology
Contact time: 2 ppw 1 web-based period per week 1 lpw
Period of presentation: Semester 2
Language of tuition: English **Credits:** 20
Module content:
Legislation for sustainable development within the framework of international agreements, the different acts affecting water quality and water use, the SEMAs within the NEMA framework, the NEMA EIA regulations, legislation pertaining to hazardous substances, interaction between mining development and NEMA, energy law, strategic environmental legislation, marine and coastal management.

ENV 822 International environmental management systems 822
Academic organisation: Zoology and Entomology
Contact time: 20 lpw
Period of presentation: Semester 2
Language of tuition: English **Credits:** 40
Module content:
The ISO framework, environmental risks and opportunities for companies, global environmental concerns, environmental legislation, identification of environmental impacts, environmental certification and auditing, follow-up activities, the Forestry Stewardship Council framework, chain of custody requirements, production standards, FSC reporting.

ENV 833 Trees in a multifunctional landscape 833
Academic organisation: Plant Production and Soil Science
Contact time: 5 dpw

Period of presentation: Quarter 3
Language of tuition: English **Credits:** 20
Module content:
Place and role of trees in multifunctional rural landscapes. Trees outside forests. Multipurpose trees. Trees and biodiversity. Trees and environmental services. Trees and sustainable development. Domesticated forests. Agroforestry (definition, classification, challenges and examples). Multiple use of forests and trees. Non-timber tree and forest products. Domestication of multipurpose trees. Forests and people. Trees and agricultural production systems (yield, interactions, synergy, competition, pests and diseases). Case-study examples from sub-Saharan Africa.

ENV 891 Research project 891
Academic organisation: Zoology and Entomology
Period of presentation: Year
Language of tuition: English **Credits:** 120
Module content:
The student needs to conduct a research project under the supervision of an academic member of staff associated with the Centre for Environmental Studies. This project needs to be of a sufficient quality to be publishable in the open scientific literature. The research report is examined as a manuscript for a suitable journal.

EWM 810 Water quality management 810
Academic organisation: Microbiology and Plant Pathology
Contact time: 20 discussion classes
Period of presentation: Semester 2
Language of tuition: English **Credits:** 20
Module content:
Severity of waterborne disease, accurate risk analysis, emergence of pathogens resistant to disinfection, the use of indicator organisms, toxicity risks, viral and protozoal contamination, water-borne diseases surveillance, epidemiology of water-borne diseases, water quality standards and monitoring, education.

EWM 821 Water conservation and demand management 821
Academic organisation: Microbiology and Plant Pathology
Contact time: 20 discussion classes
Period of presentation: Semester 2
Language of tuition: English **Credits:** 20
Module content:
Public access to information regarding water quality, water supply sustainability and public education, demand projections, water management efficiency systems approach to water management, watershed protection, drinking water treatment and distribution, wastewater collection and treatment, effects of deforestation and treatment, and complex water system developments, destruction of wetlands, effects of recreation, agriculture and aquaculture on eutrophication.

FOR 831 General introduction to forestry 831
Academic organisation: Plant Production and Soil Science
Contact time: 1 web-based period per week 20 discussion hours per block week
Period of presentation: Semester 1
Language of tuition: English **Credits:** 20
Module content:
What is forestry? Global forest resources. Natural forests and plantations in Southern

Africa. Forestry systems (natural, multipurpose forests, plantation forestry, agroforestry). Sustainable forestry development policy and legislation. Silviculture and management of plantations. Forest certification. Effects of site and silviculture on wood quality. Forest harvesting, utilisation and forest wood products. Non-timber forest products of natural and plantation forests. Forests and woodlands management (forest planning; forest mensuration, growth and yield estimates and regulation). Environmental management of natural and plantation forests. Forestry research. Human resource management in forestry. This module will also have a field practical expedition to introduce students to the field experience.

FOR 832 Forest resource use planning and management 832
Academic organisation: Plant Production and Soil Science
Contact time: 1 web-based period per week 20 discussion hours per block week
Period of presentation: Semester 1
Language of tuition: English **Credits:** 20
Module content:
Forest planning. Forest mensuration. Growth and yield models and its application in growth and yield simulators. Quantitative silviculture. Yield regulation and forest economics. GIS and spatial analysis in forestry.

FOR 833 Forest engineering 833
Academic organisation: Plant Production and Soil Science
Contact time: 1 web-based period per week 20 discussion hours per block week
Period of presentation: Semester 2
Language of tuition: English **Credits:** 20
Module content:
Forest road engineering. Forest road system management. Forest operations analysis. Production planning. Strategic and tactical planning techniques. Forest operations design. Forest transportation systems. Harvesting management. Logging mechanics.

FOR 834 Wood science and forest products 834
Academic organisation: Plant Production and Soil Science
Contact time: 1 web-based period per week 20 discussion hours per block week
Period of presentation: Semester 2
Language of tuition: English **Credits:** 20
Module content:
Common characteristics of wood. Properties controlling the technical performance of wood. Natural growth phenomena affecting wood quality. Effect of site and silviculture on wood quality. The genetics of wood. Sawmilling and wood drying. Composite wood products. Deterioration of wood and wood products and methods of protection.

FOR 835 Forest ecology and management 835
Academic organisation: Plant Production and Soil Science
Contact time: 1 web-based period per week 20 discussion hours per block week
Period of presentation: Semester 2
Language of tuition: English **Credits:** 20
Module content:
Structure and function of natural forests, species composition and diversity, disturbance processes and regimes, recovery (succession) concepts and theory, biodiversity in forest ecosystems, energy and nutrient flux in natural forest ecosystems. Resource assessment and planning. Silvicultural systems and management of natural forests (and woodlands), natural regeneration and forest rehabilitation management for sustainability of natural

forest ecosystems: multiple use for timber and non-timber forest products, forest rehabilitation (invader plants, mining, degraded forests).

FOR 836 Silviculture 836
Academic organisation: Plant Production and Soil Science
Contact time: 20 dpw 1 web-based period per week
Period of presentation: Semester 1
Language of tuition: English **Credits:** 20
Module content:
Understand the development of modern plantation forestry. Commercial plantation species. Forest pests and diseases. Forestry site classification. Basis of forestry rotation length (economics, biological, wood quality). Effect of silvicultural practices on wood quality (managing wood quality). Forestry management regimes for different species and end products. Pros and cons of plantation forestry on the environment. Fire management. Propagation techniques for forestry systems and bio-renewable resources, ecological basis of silviculture and fire management systems.

FOR 890 Forest science 890
Academic organisation: Plant Production and Soil Science
Period of presentation: Year
Language of tuition: English **Credits:** 240
Module content:
*Interdepartmental programme. The curriculum is determined by the heads of department in the biological sciences and will include the research methodology and scientific writing. This is followed by research in the area of the chosen specialisation in Forest Science culminating in the preparation and submission of research dissertation.

FPP 801 Advanced courses 801
Academic organisation: Food Science
Period of presentation: Year
Language of tuition: English **Credits:** 90

FPP 890 Mini-dissertation 890
Academic organisation: Food Science
Period of presentation: Year
Language of tuition: English **Credits:** 150

FSK 800 Physics 800
Academic organisation: Physics
Contact time: 6 lpw
Period of presentation: Year
Language of tuition: Both Afr and Eng **Credits:** 1

FSK 808 Physics 808
Academic organisation: Physics
Contact time: 2 lpw
Period of presentation: Year
Language of tuition: Both Afr and Eng **Credits:** 36

FSK 890 Dissertation: Physics 890
Academic organisation: Physics
Period of presentation: Year
Language of tuition: Both Afr and Eng **Credits:** 210

FST 801 Advanced food science 801
Academic organisation: Food Science
Contact time: 3 spw
Period of presentation: Year
Language of tuition: English **Credits:** 20
Module content:
Any one module and/or assignment(s) at the advanced level chosen in consultation with the head of department.

FST 890 Dissertation: Food science 890
Academic organisation: Food Science
Period of presentation: Year
Language of tuition: English **Credits:** 220
Module content:
Each candidate must write a dissertation on his/her research project in Food science and/or Food technology and at least a concept research paper for publication in a peer-reviewed scientific journal.

GDK 800 Soil science 800
Academic organisation: Plant Production and Soil Science
Contact time: 1 dpw
Period of presentation: Year
Language of tuition: Both Afr and Eng **Credits:** 80
Module content:
Any module and/or assignment(s) at the advanced level chosen in consultation with the head of department.

GDK 801 Advanced coursework 801
Academic organisation: Plant Production and Soil Science
Contact time: 1 dpw
Period of presentation: Year
Language of tuition: Both Afr and Eng **Credits:** 120
Module content:
Any module and/or assignment(s) at the advanced level chosen in consultation with the head of department.

GDK 890 Dissertation: Soil science 890
Academic organisation: Plant Production and Soil Science
Period of presentation: Year
Language of tuition: Both Afr and Eng **Credits:** 160
Module content:
Each candidate must write a dissertation on his/her research project in Soil Science and at least prepare a concept research paper for publication in a peer-reviewed scientific journal.

GDK 891 Mini-dissertation: Soil science 891
Academic organisation: Plant Production and Soil Science
Period of presentation: Year
Language of tuition: Both Afr and Eng **Credits:** 120
Module content:
Each candidate must write a mini-dissertation on his/her research project in land-use planning and at least prepare a concept research paper for publication in a peer-reviewed scientific journal.

GGF 890 Dissertation: Geography 890
Academic organisation: Geography, Geoinformatics and Meteorology
Period of presentation: Year
Language of tuition: Both Afr and Eng **Credits:** 240

GIS 890 Dissertation: Geoinformatics 890
Academic organisation: Geography, Geoinformatics and Meteorology
Period of presentation: Year
Language of tuition: Both Afr and Eng **Credits:** 240

GLG 881 Mini-dissertation 881
Academic organisation: Geology
Period of presentation: Year
Language of tuition: English **Credits:** 120
Module content:
A mini-dissertation on a topic approved by the course leader. In this module candidates must do a research project in order to show that they have mastered the theoretical knowledge covered in the theoretical modules and can apply it to a research topic from their own industrial experience.

GLG 890 Dissertation: Geology 890
Academic organisation: Geology
Period of presentation: Year
Language of tuition: Both Afr and Eng **Credits:** 240

GMO 800 Geometrical optics 800
Academic organisation: Physics
Contact time: 1 lpw
Period of presentation: Year
Language of tuition: Afrikaans **Credits:** 36
Module content:
Mathematical description of waves; Light as an electromagnetic wave; Nature of sources of light; Wave fronts (Huygens principle); Snell's Law; Index of refraction; Exploration of the laws of reflection and refraction at planar and curved surfaces; Ray tracing methodology to find position, Nature of images and magnification; Thin lens formula; Conjugate foci formula; Lensmaker's formula; Ophthalmic prisms: characteristics, classification and refractive power; Thin lenses: types, image formation; Cylindrical lenses: Introduction; Optical systems: Lens combinations (notation, toric lenses); Thick lenses (cardinal points, system power); The eye: structure and function, reduced eye; aberrations in general; eye defects: myopia, hyperopia, presbyopia, astigmatism; Optical apparatus for ophthalmology: invasive/non-invasive, ophthalmic laser, ophthalmoscope, fundus camera, light coagulator.

GTK 890 Dissertation: Genetics 890
Academic organisation: Genetics
Period of presentation: Year
Language of tuition: English **Credits:** 240

GVK 800 Large stock science 800
Academic organisation: Animal and Wildlife Sciences
Contact time: 1 lpw 1 dpw
Period of presentation: Year

Language of tuition: English **Credits:** 30
Module content:
Management programmes and systems for beef cattle, dairy cattle and horses. Optimal use of breeds and regional adaptation of cattle. The stud industry and commercial units. Indigenous breeds and production development. The application of animal science practices and the practise of techniques for breed improvement. Seminars, class discussions, literature studies and assignments on certain fields. Research and production techniques. Agro-economic, agro-ecological and socio-economic assignments can be prescribed.

HSC 801 Advanced coursework 801
Academic organisation: Plant Production and Soil Science
Contact time: 2 dpw 1 spw
Period of presentation: Semester 1
Language of tuition: Both Afr and Eng **Credits:** 120
Module content:
Any module and/or assignment(s) at the advanced level chosen in consultation with the head of department.

HSC 891 Mini-dissertation: Horticultural science 891
Academic organisation: Plant Production and Soil Science
Period of presentation: Year
Language of tuition: Both Afr and Eng **Credits:** 120
Module content:
Each candidate must write a dissertation on his/her research project in Horticulture and at least prepare a concept research paper for publication in a peer-reviewed scientific journal.

HSK 810 Theoretical frameworks in cultural studies 810
Academic organisation: Consumer Science
Contact time: 15 hours per block session
Period of presentation: Semester 2
Language of tuition: English **Credits:** 15
Module content:
The interaction between the nature of man as a living being and the environment, in which he has to survive, is studied from a cultural and an existential approach. The interrelationships between beliefs, values and attitudes are studied as well as the socio-cultural adjustments that man has to make when cultures come into contact.

HSK 812 Theoretical frameworks in consumer studies 812
Academic organisation: Consumer Science
Contact time: 15 hours per block session
Period of presentation: Semester 1
Language of tuition: English **Credits:** 15
Module content:
Consumer orientation is a study of consumer behaviour within a systems theory approach. Special emphasis is placed on inter-related factors that influence consumers' decision making and consumer socialisation, as well as processes during which a consumer's general behaviour is shaped. Models used to structure the consumer's decision-making process as well as the South African consumer within the context of the global market, are studied.

HSK 813 Socio-cultural studies 813
Academic organisation: Consumer Science
Contact time: 15 hours per block session
Period of presentation: Semester 1
Language of tuition: English **Credits:** 15
Module content:
Symbolic interactionism focuses on the nature of interaction and the dynamic social activities taking place between persons. The human being is understood as acting in the present, influenced by what is happening now. Human beings are seen as active and dynamic. Interaction is not only what is happening between people, but also what is happening within the person.
A social cognitive perspective focuses primarily on how people form impressions about one another and about one self. The process through which people seek knowledge about others is called social perception, while the process through which people make judgments about others and themselves are called social cognition.
The life course perspective is used in the field of social studies where explanations of continuity and change are needed. It addresses the dynamic interface between lives and social structures over time. The life course perspective views peoples' lives across their lifespan, emphasizing life course trajectories (paths) and transitions (changes) while taking into account life stage, social structure and events throughout peoples' lives.

IGL 890 Dissertation: Engineering geology 890
Academic organisation: Geology
Period of presentation: Year
Language of tuition: Both Afr and Eng **Credits:** 200

ITW 880 Interior merchandise 880
Academic organisation: Consumer Science
Prerequisite: HSK 812 (Theoretical frameworks in Consumer studies)
Contact time: 30 hours per block session
Period of presentation: Semester 2
Language of tuition: English **Credits:** 30
Module content:
The buying function in interior retail with special reference to buyer responsibility, merchandise and purchase planning; analysis and evaluation of the national and international markets and trends. A special focus on the South African market: consumer needs, market trends and responsibilities. Learners are exposed to the retail practice, case and research studies.

ITW 881 Equipment studies 881
Academic organisation: Consumer Science
Prerequisite: HSK 812 (Theoretical frameworks in consumer studies)
Contact time: 30 hours per block session
Period of presentation: Semester 1
Language of tuition: English **Credits:** 30
Module content:
The following study themes are included:
- A global perspective towards the selection and use of household appliances and merchandise;
- A comparative study of the energy consumption and operation principles of household appliances and merchandise;
- Applied ergonomics.

ITW 882 Socio-psychological aspects of housing and interior 882
Academic organisation: Consumer Science
Prerequisite: HSK 810 (Theoretical frameworks in cultural studies) and/or HSK 813 (Socio-cultural studies) and HSK 812 (Theoretical frameworks in consumer studies)
Contact time: 30 hours per block session
Period of presentation: Semester 2
Language of tuition: English **Credits:** 30
Module content:
Understanding the social, psychological and cultural aspects of housing and purchasing of interior products: A South African perspective.

KLD 880 Social aspects of clothing 880
Academic organisation: Consumer Science
Prerequisite: HSK 810 and HSK 813
Contact time: 30 hours per block session
Period of presentation: Semester 2
Language of tuition: English **Credits:** 30
Module content:
A social-psychological and cultural study of the interaction between the individual, his/her dress and the social environments as well as the emergent meanings. Symbolic inter-actionism, social cognition and cultural theoretical frameworks are used.

KLD 883 Clothing: Product development 883
Academic organisation: Consumer Science
Contact time: 30 hours per block session
Period of presentation: Semester 1
Language of tuition: English **Credits:** 30
Module content:
The focus is on aspects primarily concerned with product development, for instance product analysis, line planning and line development, product standards and specifications, costs and product implications. Study methods and projects are planned in such a way that the student can gain first-hand experience.

KLD 884 Clothing merchandising management 884
Academic organisation: Consumer Science
Contact time: 2 lpw
Period of presentation: Semester 1
Language of tuition: English **Credits:** 30
Module content:
The South African clothing retail industry, including traditional and developing/new marketing channels, is studied. Analysis and evaluation of the present situation in the South African clothing retail industry. Developing forms of retailing and marketing in the clothing industry in South Africa with emphasis on the informal sector and direct marketing are also studied.

KVK 800 Small stock science 800
Academic organisation: Animal and Wildlife Sciences
Contact time: 1 dpw 1 lpw
Period of presentation: Year
Language of tuition: English **Credits:** 30
Module content:
Advanced aspects of the small stock industry. The wool, fur and meat production

potential of South Africa. Production trends and factors influencing them. Production systems. The influence of flock composition on production. Discussions, seminars and prescribed scientific literature studies on various aspects of the small stock industry.

LEK 800 Agricultural economics 800
Academic organisation: Agricultural Economics, Extension and Rural Development
Period of presentation: Year
Language of tuition: Both Afr and Eng **Credits:** 20

LEK 810 Agricultural economics 810
Academic organisation: Agricultural Economics, Extension and Rural Development
Prerequisite: LEK 725 or equivalent
Contact time: 1 ppw 1 lpw
Period of presentation: Semester 1
Language of tuition: English **Credits:** 20
Module content:
Econometrics. Linear regression: assumptions of the linear regression model, OLS estimators and properties, hypothesis testing (single and multiple restrictions), forecasting, dummy variables. Violations of the linear model assumptions: multi-colinearity, heteroscedasticity, serial correlation and distributed lag models, (GLS estimators). Advanced topics: Quantitative response models (logit, tobit and probit analysis) co-integration, instrumental variables and 2-stage least squares.

LEK 814 Agricultural economics: Quantitative models for agricultural policy 814
Academic organisation: Agricultural Economics, Extension and Rural Development
Contact time: 1 lpw 1 ppw
Period of presentation: Semester 1
Language of tuition: English **Credits:** 15
Module content:
Quantitative models for agricultural policy and planning. Multi-sector models: Input-output and programming models and social accounting matrices for consistent production planning, growth, income distribution and trade policy analysis. Multimarket analysis. Computable general equilibrium models.

LEK 820 Partial equilibrium modelling and commodity market analysis 820
Academic organisation: Agricultural Economics, Extension and Rural Development
Prerequisite: EKT 723 or LEK 810
Contact time: 1 ppw 1 lpw
Period of presentation: Semester 2
Language of tuition: English **Credits:** 15
Module content:
This module focuses on the modelling of agricultural commodity markets, price determination, policy and trade. The main objective is to provide the basic theoretical principles and skills for partial-equilibrium model building and an opportunity to apply these skills. The approach will include:
1) Economic theory: The theoretical foundations of each modelling component of a typical commodity balance sheet and set of prices will be emphasised in the design and specification of models; price formation and model closure under alternative equilibrium pricing conditions
2) Applied research: Advanced steps in modelling will be emphasised. Throughout the module, applied modelling research will be conducted and presented to gain experience with methods discussed in class. The module applies economic theory and quantitative

methods to analyse food and agricultural markets, price, trade and policy issues. The module examines problem formulation, model structure, estimation, and model evaluation applied to demand and supply and to trade and policy interventions.

LEK 826 Environmental valuation and policy 826
Academic organisation: Agricultural Economics, Extension and Rural Development
Contact time: 1 lpw
Period of presentation: Semester 2
Language of tuition: English **Credits:** 15
Module content:
Environmental valuation and policy. This module will review the basic principles of microeconomic theory needed for understanding and analysis of environmental problems, introduce market and non-market techniques of valuation of natural resources and environmental services (hedonic pricing, contingent valuation, transport cost, willingness-to-pay, cost-based techniques, etc.), public goods and environmental externalities, property rights regimes and selection of appropriate environmental policy instruments for management of environmental externalities.

LEK 831 Forest resource economics and policy 831
Academic organisation: Plant Production and Soil Science
Contact time: 2 lpw
Period of presentation: Semester 2
Language of tuition: English **Credits:** 20
Module content:
The economics of optimal management of cultivated and natural forests. Optimal rotation age and harvesting in timber production. Managing forest for their non-timber services. The multiple ecosystem services of forest and their contributions to human wellbeing. Economic valuation of the services of forest ecosystems. Forest resource rents and their capture and distribution under different property rights regimes. Regulation and taxation of forest users. Designing logging concessions and forest exploitation policies. Forest resource accounting and optimal management of the resource rents. Communities and forests. Case study examples from Sub-Saharan Africa.

LEK 832 Agricultural science and technology policy 832
Academic organisation: Agricultural Economics, Extension and Rural Development
Prerequisite: Registration for at least a master's degree
Contact time: 32 contact hours
Period of presentation: Semester 1 or 2
Language of tuition: English **Credits:** 15
Module content:
The basic definitions and concepts related to agricultural science policy. An overview of the trends in research investment, capacity development in the field of agricultural research, juxtaposed against the regional and international performance in this field. The application of concepts and methodologies used in project planning and management with respect to research evaluation and monitoring. Productivity analysis and its use in evaluating technological change, the determination of the R&D effects in terms of agricultural research and development. Case studies dealing with current topics in agricultural science policy highlighting the application of the methodologies learned.

LEK 833 Food policy 833
Academic organisation: Agricultural Economics, Extension and Rural Development
Prerequisite: Registration for at least a master's degree

Contact time: 32 contact hours
Period of presentation: Semester 1 or 2
Language of tuition: English **Credits:** 15
Module content:
The concept and interrelated causes of food insecurity (production, markets and socio-economic climate) and the global food economy. Household coping strategies and response to risk and shocks. Household dynamics (including livelihoods, purchasing behaviour and nutrition). Practical tools for programme and policy analysis and targeting. Evaluation of possible programme and policy options and their effectiveness in terms of achieving comprehensive and pro-poor growth.

LEK 834 Measuring and monitoring food security 834
Academic organisation: Agricultural Economics, Extension and Rural Development
Prerequisite: Registration for at least a master's degree
Contact time: 32 contact hours
Period of presentation: Semester 2
Language of tuition: English **Credits:** 15
Module content:
Indicators, scores, indexes, measurement approaches, systems and analysis methods, for food security monitoring and evaluation. Best practice for surveys and qualitative methodologies. Communicating research results and food security information for decision makers. The data included in the module will cover agricultural crop and livestock, food stocks, nutrition, health, agrometerological, behavioural and sanitation related information.

LEK 882 Institutional economics 882
Academic organisation: Agricultural Economics, Extension and Rural Development
Prerequisite: MIE 780
Contact time: 1 lpw
Period of presentation: Semester 2
Language of tuition: English **Credits:** 15
Module content:
Institutional and behavioural economics. This module will expose students to the principles of the New Institutional Economics paradigm and how it can be utilised to improve the analysis of agricultural economic and agricultural development problems and issues. Major themes covered are: The agricultural development challenge: stylised features; new institutional economics: distinctive features and concepts; institutions and development: A historical and macro-perspective techno-economic characteristics and agricultural systems and products in poor countries; NIE analysis of markets and markets structures; the State: Political and institutional determinants of agricultural policy; collective action; transactions costs in smallholder agriculture; case studies.

LEK 883 Agricultural supply chain management 883
Academic organisation: Agricultural Economics, Extension and Rural Development
Contact time: 1 lpw
Period of presentation: Year
Language of tuition: English **Credits:** 15
Module content:
Agricultural supply chain analysis. Explore the evolution of supply chain management in the global food industry. Establish the different ways in which supply chain management can provide a source of competitive advantage at industry level and for individual firms. Examine the crossfunctional and multidisciplinary nature of supply chain management as

it applies in the global food industry. Introduce the core elements of the theoretical literature on supply chain management and consider applications in different sectors. Provide students with practical experience in applying the principles of supply chain management to the exploitation of a marketing opportunity, using case examples from the fresh produce and meat sectors. Provide students with practical experience of undertaking a supply chain audit, with a view to establishing an appropriate business strategy for a food manufacturing company.

LEK 886 The economics of natural resources 886
Academic organisation: Agricultural Economics, Extension and Rural Development
Prerequisite: LEK 780 and LEK 810 or equivalents
Contact time: 1 lpw
Period of presentation: Semester 2
Language of tuition: English **Credits:** 15
Module content:
The economics of natural resources. This module will introduce students to the techniques of optimisation overtime, optimal allocation and management of non-renewable and renewable resources, with case studies from Africa. The influence of property rights regimes on optimal natural resource use will also be stressed. The module consists of three main sections: Methods of dynamic optimisation; Theory of exhaustible and renewable resources and growth models; and Property rights and natural resource use with case studies from Africa.

LEK 887 Selected topics in environmental economics 887
Academic organisation: Agricultural Economics, Extension and Rural Development
Prerequisite: MIE 780 and EKT 713 or equivalents
Contact time: 1 lpw
Period of presentation: Semester 2
Language of tuition: English **Credits:** 15
Module content:
Selected topics in environmental economics. This module will introduce students to various issues of special importance in environmental economics and policy with special emphasis on international dimensions. Examples of key themes to be covered include trade and the environment, trans-boundary externalities, global public goods, multi-lateral environmental agreements, international aid, economic growth and environmental change, poverty and the environment, etc. The main objective of the module is to equip students with the appropriate tools for analysing the linkages between economic development, trade and globalization, poverty, economic and environmental policy and environmental change.

LEK 890 Dissertation: Agricultural economics 890
Academic organisation: Agricultural Economics, Extension and Rural Development
Period of presentation: Year
Language of tuition: Both Afr and Eng **Credits:** 180

LEK 891 Mini-dissertation 891
Academic organisation: Agricultural Economics, Extension and Rural Development
Period of presentation: Year
Language of tuition: Both Afr and Eng **Credits:** 100

LEK 898 Dissertation: Agricultural economics 898
Academic organisation: Agricultural Economics, Extension and Rural Development

Period of presentation: Year
Language of tuition: Both Afr and Eng **Credits:** 120

MBY 890 Dissertation: Microbiology 890
Academic organisation: Microbiology and Plant Pathology
Period of presentation: Year
Language of tuition: Both Afr and Eng **Credits:** 240

MFK 800 Medical physics 800
Academic organisation: Physics
Contact time: 2 lpw
Period of presentation: Year
Language of tuition: English **Credits:** 36

MFK 801 Medical physics 801
Academic organisation: Physics
Contact time: 2 lpw
Period of presentation: Year
Language of tuition: English **Credits:** 36

MPS 890 Dissertation: Medical plant science 890
Academic organisation: Plant Science
Period of presentation: Year
Language of tuition: English **Credits:** 240

MVA 880 Multivariate analysis 880
Academic organisation: Statistics
Contact time: 1 lpw
Period of presentation: Semester 1 or Semester 2
Language of tuition: English **Credits:** 30
Module content:
Data Mining - Organisation of data and exploratory data analysis. Computational and Statistical data mining. Evaluation of data mining methods. Business cases. Supervised learning. Linear methods for regression, classification and prediction.

NLB 871 The philosophy, principles and ethics of wildlife management 871
Academic organisation: Animal and Wildlife Sciences
Contact time: 1 web-based period per week
Period of presentation: Year
Language of tuition: English **Credits:** 10
Module content:
Ethics must be seen as a distillation of past experience, made available for future decisions. This confirms the inter-relatedness between ethics and principles in that all principles must be applied with judgement derived from ethics. Fundamentally, principles can be stated simply, but they may be complex concepts because all principles are inter-related.

NLB 872 Man and nature conservation 872
Academic organisation: Animal and Wildlife Sciences
Contact time: 1 web-based period per week
Period of presentation: Year
Language of tuition: English **Credits:** 5

Module content:
Humans continue to seek an optimally satisfactory fit that involves both nature and culture. Culture is carved out against a backdrop of, and from nature with the resultant dimensions of conflict between man and nature. Every organism of this world is set against its world, and culture intensifies this opposition. It therefore stands to reason that the opposition will cause degradation of the habitat that humans occupy.

NLB 873 Veld management 873
Academic organisation: Animal and Wildlife Sciences
Contact time: 1 web-based period per week
Period of presentation: Year
Language of tuition: English **Credits:** 7
Module content:
Even when veld management is based on thorough knowledge of plant communities, correct management is not consistently definable. The task of quantitatively assessing the various combinations of enterprises and management systems available to the wildlife manager, is both daunting and unachievable. Veld management is therefore based on a philosophy of adaptive management.

NLB 874 Plant identification 874
Academic organisation: Animal and Wildlife Sciences
Contact time: 1 web-based period per week
Period of presentation: Year
Language of tuition: English **Credits:** 5
Module content:
Grasses and trees that occur in southern Africa are dealt with in a systematic order, describing their main features and position within the taxonomic systems. This module is supported with visuals of the flowering stages of the various plants.

NLB 875 Vegetation dynamics 875
Academic organisation: Animal and Wildlife Sciences
Contact time: 1 web-based period per week
Period of presentation: Year
Language of tuition: English **Credits:** 5
Module content:
The determination of the grazing and browsing capacity for a given area creates considerable problems, since old ideas on fixed figures and large-animal stock unit equivalents appear to have little or no use in practice. The grazing and browsing capacity of large natural areas is based on the habitat diversity, veld condition and plant composition peculiar to that particular area.

NLB 876 Reptile biology and identification 876
Academic organisation: Animal and Wildlife Sciences
Contact time: 1 web-based period per week
Period of presentation: Year
Language of tuition: English **Credits:** 5
Module content:
The herpetological classification of snakes and their biological features such as habitat selection, breeding behaviour and feeding. Toxicity of certain species is dealt with and how they can affect humans and the treatments of snakebites. The biology of other reptiles is also dealt with, in particular those of economic importance such as crocodiles. The principles of crocodile farming are discussed.

NLB 877 Mammalogy 877
Academic organisation: Animal and Wildlife Sciences
Contact time: 1 web-based period per week
Period of presentation: Year
Language of tuition: English **Credits:** 5
Module content:
In this module, the emphasis is on large mammals, dealing with the systematic classification and biology of antelopes and carnivores. Descriptions of habitat preferences, reproductive behaviour, feeding behaviour and predator-prey interactions are given.

NLB 878 Wildlife nutrition 878
Academic organisation: Animal and Wildlife Sciences
Contact time: 1 web-based period per week
Period of presentation: Year
Language of tuition: English **Credits:** 10
Module content:
The functioning of the ruminant digestive system is far more complex than the hind-gut fermenting system that is found in monogastric species. Food selection and the composition of food resources determine the efficiency with which herbivores can transform this source of energy and nutrients. The balance between production and consumption of vegetation is important in wildlife management. Physical and chemical defense in plants is discussed and how they influence feed selection and digestion in herbivores. The feeding ecology of wildlife in confined conditions through supplementary feeding is discussed.

NLB 879 Wildlife management techniques 879
Academic organisation: Animal and Wildlife Sciences
Contact time: 1 web-based period per week
Period of presentation: Year
Language of tuition: English **Credits:** 6
Module content:
The practical aspects of wildlife management includes burning programmes of vegetation, correct counting techniques, calculating ecological capacity, provision of water, wildlife capture techniques for various species and the handling of these species. Important aspects are holding bomas, care of animals in confinement, construction of containers and transportation and different harvesting techniques. The use of tick control methods, tracking of animals and GPS use are also dealt with in this module.

NLB 880 Parasites and diseases of wildlife 880
Academic organisation: Animal and Wildlife Sciences
Contact time: 1 web-based period per week
Period of presentation: Year
Language of tuition: English **Credits:** 5
Module content:
Wildlife is less subjected to diseases than is the case in domestic stock. This holds true in particular with free-ranging wildlife. However, where wildlife comes into contact with domestic stock, diseases are often transmitted through parasites such as foot-and-mouth disease, tuberculosis, anthrax, heartwater and corridor disease. The taxonomic classification of parasites is discussed, as well as their life-cycles, hosts and treatment for the diseases that they transmit.

NLB 881 Game ranch and nature reserve economics 881
Academic organisation: Animal and Wildlife Sciences
Contact time: 1 web-based period per week
Period of presentation: Year
Language of tuition: English **Credits:** 5
Module content:
Management of wildlife ranches and nature reserves does not only entail looking after animals, but these areas also have to be managed economically if they are to be sustained. Most of the private wildlife ranches, and even smaller national parks, operate on meagre profits, usually because their operations are too small or because they have an insufficient focus on multiple-use. Simple economic principles are discussed to assist the manager of a wildlife reserve or ranch.

NLB 882 Animal population dynamics 882
Academic organisation: Animal and Wildlife Sciences
Contact time: 1 web-based period per week
Period of presentation: Year
Language of tuition: English **Credits:** 7
Module content:
The main aspects of animal populations that are particularly important in wildlife ranch management are the growth, age and sex composition, social organisation and behaviour of that population. These aspects can act singly or in combination, but all are linked to the population's potential to increase, through the balance between natality (births) and mortality (deaths) in the population.

NLB 883 Ecotourism 883
Academic organisation: Animal and Wildlife Sciences
Contact time: 1 web-based period per week
Period of presentation: Year
Language of tuition: English **Credits:** 7
Module content:
Within African conservation, ecotourism is extremely important in sustaining conservation efforts. Minimum impact of tourism infrastructure is discussed as well as the tourism capacity of nature reserves. Practical aspects such as hiking trails, 4x4 routes, horse trails, game drive etiquette and placement of hides for optimal viewing make the outdoor experience memorable. Tourism will ensure the future of wildlife conservation in Africa.

NLB 884 Wildlife and the law 884
Academic organisation: Animal and Wildlife Sciences
Contact time: 1 web-based period per week
Period of presentation: Year
Language of tuition: English **Credits:** 7
Module content:
Although many regulations and laws exist to regulate the wildlife industry, proper enforcement of these laws is essential. A wildlife manager must have knowledge of the laws regulating this industry in order to be successful.

NLB 885 Wildlife utilisation 885
Academic organisation: Animal and Wildlife Sciences
Contact time: 1 web-based period per week
Period of presentation: Year
Language of tuition: English **Credits:** 7

Module content:
Modern man has put wildlife in confined areas to protect and ensure the survival of species. Utilisation becomes an important issue in these fenced-in areas. Ecotourism can be viewed as non-consumptive wildlife utilisation. Harvesting of wildlife is defined as consumptive wildlife utilisation. This module addresses aspects concerning these principles.

NLB 886 Practical studies 886
Academic organisation: Animal and Wildlife Sciences
Contact time: 1 web-based period per week 40 discussion periods over 14 days
Period of presentation: Year
Language of tuition: English **Credits:** 60
Module content:
Further to the above web-based theoretical but visible modules, a 21 day full-time practical module must be completed. This is viewed as one module under a single code. This module deals with the following practical topics in the field:
1. Wildlife capture techniques (8 credits)
2. Veld condition assessment methods (8 credits)
3. Plant identification methods (5 credits)
4. Wildlife tracking of big game (5 credits)
5. Visits to sustainable use programmes (5 credits)
6. Off-road driving skills and first aid (3 credits)
7. Bird identification and habitat management (3 credits)
8. Practical wildlife management techniques (7 credits)
9. Interaction with communal rural communities related to nature conservation (8 credits)
10. Ecotourism hospitality (8 credits)

NLB 887 Research project 887
Academic organisation: Animal and Wildlife Sciences
Period of presentation: Year
Language of tuition: English **Credits:** 84
Module content:
The dissertation is based on an individual research project by each candidate, including a module on research methology.

NLB 890 Dissertation: Wildlife management 890
Academic organisation: Animal and Wildlife Sciences
Period of presentation: Year
Language of tuition: Both Afr and Eng **Credits:** 240

NMN 814 Research methodology 814
Academic organisation: Consumer Science
Contact time: 1 lpw
Period of presentation: Year
Language of tuition: English **Credits:** 30
Module content:
The aim of this module is to analyse the core concepts in social research and to provide a conceptual framework of the research process. It includes the following topics: a conceptual model of social science research, the logic of the research process, the different forms of scientific reasoning, and the stages in the research process being the formulation of the research problem, research design, conceptualisation, operationalisation, sampling, data-collection and data-analysis. After the completion of this section,

an introduction to interpretive approaches and qualitative research methods are given and contrasted with quantitative methods. This module also includes the main types of research designs and notions such as validity and reliability as well as the ethics and politics of research. In conclusion the writing of a research proposal receives attention.

OMS 881 Environmental change 881
Academic organisation: Geography, Geoinformatics and Meteorology
Period of presentation: Year
Language of tuition: Both Afr and Eng **Credits:** 20
Module content:
This module involves the study of the causes and consequences of environmental change from multidisciplinary perspectives. A focus of this course is human environmental interactions. Past processes leading to environmental change will also be discussed. In a given period, the following will be investigated: principles of environmental change, causes and consequences of environmental change, Global warming and climate change: causes and impacts of climate change on natural resources; water, forests, biodiversity, land use and land cover change, environmental/climate change and infectious disease, human dimensions of global change and climate change political responses including the Kyoto protocol. Mitigation and adaptation strategies to climate change and effects of climate change on sustainable development.

OMS 895 Research Report: Environment and Society 895
Academic organisation: Geography, Geoinformatics and Meteorology
Period of presentation: Year
Language of tuition: Both Afr and Eng **Credits:** 20

PFS 801 Production physiology 801
Academic organisation: Animal and Wildlife Sciences
Period of presentation: Year
Language of tuition: Both Afr and Eng **Credits:** 30
Module content:
Specialised study of physiological and anatomical factors that influence growth, development, reproduction and production. Stress and intensification effects on the metabolism of animals. The mechanisms of disease and erosion losses and the modification of reproduction and growth.

PFS 802 Production physiology 802
Academic organisation: Animal and Wildlife Sciences
Period of presentation: Year
Language of tuition: Both Afr and Eng **Credits:** 30
Module content:
A study of specific topics by way of literature, seminars, discussions and research assignments. Each student does a research project and compiles a research paper.

PHY 891 Relevant courses 891
Academic organisation: Physics
Contact time: 2 lpw
Period of presentation: Year
Language of tuition: English **Credits:** 30
Module content:
Relevant study courses as prescribed by the head of department.

PLG 800 Research project 800
Academic organisation: Microbiology and Plant Pathology
Period of presentation: Year
Language of tuition: English **Credits:** 60

PLG 801 Elective coursework 801
Academic organisation: Microbiology and Plant Pathology
Contact time: 3 dpw
Period of presentation: Year
Language of tuition: English **Credits:** 140
Module content:
Advanced modules in postharvest technology (and related subjects) chosen in consultation with the director of the school and the head of department.

PLG 802 Mini-dissertation 802
Academic organisation: Microbiology and Plant Pathology
Period of presentation: Year
Language of tuition: Both Afr and Eng **Credits:** 100
Module content:
Each candidate must write a mini-dissertation on his/her research project in Postharvest technology.

PPT 802 Advanced coursework 802
Academic organisation: Microbiology and Plant Pathology
Contact time: 3 dpw
Period of presentation: Year
Language of tuition: English **Credits:** 120
Module content:
Advanced courses in plant protection and/or related subjects chosen in consultation with the director of the school and the head of Plant Pathology. It is strongly advised that all candidates do AGR 783 and AGR 784.

PPT 803 Advanced coursework: Plant quarantine 803
Academic organisation: Microbiology and Plant Pathology
Contact time: 3 dpw
Period of presentation: Year
Language of tuition: English **Credits:** 120
Module content:
Advanced courses in either field of specialisation which can include Plant Pathology, Entomology, Weed Science or Plant Quarantine chosen in consultation with the director of the school and the head of the department.

PPT 890 Dissertation: Plant pathology 890
Academic organisation: Microbiology and Plant Pathology
Period of presentation: Year
Language of tuition: Both Afr and Eng **Credits:** 240

PPT 891 Dissertation: Plant potection 891
Academic organisation: Microbiology and Plant Pathology
Period of presentation: Year
Language of tuition: English **Credits:** 240

PPT 892 Mini-dissertation: Plant protection 892
Academic organisation: Microbiology and Plant Pathology
Period of presentation: Year
Language of tuition: Both Afr and Eng **Credits:** 120
Module content:
Each candidate must write a mini-dissertation on his/her project in plant protection. The mini-dissertation can be either factor- or strategic research and case studies. The candidate must have at least one paper submitted to a peer-reviewed journal.

PPT 893 Mini-dissertation: Plant quarantine 893
Academic organisation: Microbiology and Plant Pathology
Period of presentation: Year
Language of tuition: Both Afr and Eng **Credits:** 120
Module content:
Each candidate must write a mini-dissertation on his/her research project in either field of specialisation and at least a concept research paper for publication in a suitable peer reviewed journal.

PVK 800 Poultry science 800
Academic organisation: Animal and Wildlife Sciences
Contact time: 1 dpw 1 lpw
Period of presentation: Year
Language of tuition: English **Credits:** 30
Module content:
Specialised study of the management of hatcheries, broiler and layer production units, broiler breeding parent farms, ostriches, cage bird, game bird and waterfowl units, as well as threatened species in conservation programmes. Planning of production units and facilities. Determining ventilation requirements, disease control and biosecurity systems. Product quality, marketing and promotion of birds and their products. Computer-aided management systems and product projection. Execution of projects in certain areas of specialisation. Studies aimed at optimising production efficiency and minimising risk.

SCE 800 Examination: Science education 800
Academic organisation: Centre for Science Development
Period of presentation: Year
Language of tuition: Both Afr and Eng **Credits:** 1

SCE 881 Research methods in science education 881
Academic organisation: Centre for Science Development
Contact time: 2 lpw
Period of presentation: Semester 1
Language of tuition: English **Credits:** 20
Module content:
The purpose of this module is to:
- Be exposed to the discipline of Educational Research
- Understand research concepts, principles and methods
- Obtain skills such as: the formulation and definition of a research problem, the use of literature to obtain an in depth understanding of a problem, the design of the research protocol, the interpretation of research results to draw conclusions about a research problem.

SCE 882 Statistics for science education 882
Academic organisation: Centre for Science Development
Contact time: 2 lpw
Period of presentation: Semester 1
Language of tuition: English **Credits:** 20
Module content:
The module follows a conceptual approach to the field of statistical principles as applied within educational research. The emphasis lies on understanding selected statistical procedures and the logic underlying statistical deduction. The purpose of the module is to promote statistical literacy as a research tool.

SCE 883 Curriculum development and assessment – Science education 883
Academic organisation: Centre for Science Development
Contact time: 3 lpw
Period of presentation: Semester 1
Language of tuition: English **Credits:** 20
Module content:
The module reviews modern thinking in science content and curriculum development in both a South African and an international context. Assessment is treated as an integral part of curriculum design. Special attention is given to the theoretical principles of assessment, with special reference to accuracy and reliability: The application of these elements to standardised as well as teaching developed tests are reviewed. Finally, new forms of assessment are explored.

SCE 884 Current developments: Science education 884
Academic organisation: Centre for Science Development
Contact time: 3 lpw
Period of presentation: Semester 1
Language of tuition: English **Credits:** 20
Module content:
The objectives of this module are: to explore and discuss the major approaches currently advocated in science education (e.g. constructivist learning) and as they pertain to the nature of the scientific fields; to explore and discuss some current restructuring proposals underway and the consequences of the above proposals for the classroom teacher; to develop a curriculum or curricular units, strategies for the implementation of the curriculum and evaluation strategies consistent with the goals of the new curriculum and evaluation strategies consistent with the goals of the new curriculum; to explore activities, computer software, computer interfaced laboratories, video recordings and integrated technological systems that will support the new curriculum.

SCE 885 Seminar: Science education 885
Academic organisation: Centre for Science Development
Period of presentation: Semester 1
Language of tuition: English **Credits:** 20
Module content:
The purpose of the seminar is to contribute and learn from the interaction and research of fellow postgraduate students and professionals. At least 5 presentations on recent literature or your own research in science education or in a science speciality are required. The programme contributes both to the development of the underlying knowledge and research project, but also build a team approach to scientific endeavour, develops and demonstrates scientific presentation skills and scientific reporting and writing.

SCE 890 Dissertation: Science education 890
Academic organisation: Centre for Science Development
Period of presentation: Year
Language of tuition: Both Afr and Eng **Credits:** 240

STK 880 Capita selecta: Statistics 880
Academic organisation: Statistics
Contact time: 1 other per week 1 lpw
Period of presentation: Semester 1 or Semester 2
Language of tuition: English **Credits:** 30
Module content:
The module is primarily article based and covers the most recent literature that discusses the developments and research in, for example, Shewhart charts, Exponentially Weighted Moving Average (EWMA) charts, Cumulative Sum (CUSUM) charts, Q-charts, parametric and nonparametric charts, univariate and multivariate charts, Phase I and Phase II control charts and profile monitoring.

STN 880 Capita selecta: Statistics 880
Academic organisation: Statistics
Period of presentation: Semester 1 or Semester 2
Language of tuition: English **Credits:** 30

TBK 800 Horticultural science 800
Academic organisation: Plant Production and Soil Science
Period of presentation: Year
Language of tuition: Both Afr and Eng **Credits:** 80
Module content:
Any module and/or assignment(s) at the advanced level chosen in consultation with the head of department.

TBK 890 Dissertation: Horticultural science 890
Academic organisation: Plant Production and Soil Science
Period of presentation: Year
Language of tuition: Both Afr and Eng **Credits:** 160
Module content:
Each candidate must write a dissertation on his/her research project in Horticulture and at least prepare a concept research paper for publication in a peer-reviewed scientific journal.

TKS 881 Textiles and quality control 881
Academic organisation: Consumer Science
Contact time: 30 hours per block session
Period of presentation: Semester 1
Language of tuition: English **Credits:** 30
Module content:
The module focuses on the product and the consumer. Quality dimensions and end-use characteristics of the apparel product/household textiles product targeted for selling or buying are studied. Consumer perceptions of the quality of a product as influenced by aesthetics, end-use, cultural, demographic and psycho-graphic differences, individual standards and price, are investigated. Insights gained from this study are valuable to both the marketer and the consumer of apparel and household textile products.

TLR 801 Animal breeding and genetics 801
Academic organisation: Animal and Wildlife Sciences
Contact time: 1 dpw 1 spw 2 ppw
Period of presentation: Year
Language of tuition: Both Afr and Eng **Credits:** 30
Module content:
Qualitative characteristics. Calculation of population criteria and the interpretation in the industry. Specific problems with relation to the selection and breeding of cattle, small stock, pigs and poultry. The application of genetic theory in practice with relation to hereditability of quantitative characteristics.

TLR 802 Animal breeding and genetics 802
Academic organisation: Animal and Wildlife Sciences
Period of presentation: Year
Language of tuition: Both Afr and Eng **Credits:** 30
Module content:
Seminars, literature study and discussion of selected topics relating to the industry/specialisation programme. Discussion of research methods and results under local conditions. Policies regarding animal breeding.

TMN 890 Dissertation: Applied mineralogy 890
Academic organisation: Geology
Period of presentation: Year
Language of tuition: English **Credits:** 200

TRA 880 Analysis of time series 880
Academic organisation: Statistics
Prerequisite: WST 321 or TRA 720
Contact time: 1 lpw
Period of presentation: Semester 1 or Semester 2
Language of tuition: English **Credits:** 30
Module content:
Difference equations. Lag operators. Stationary ARMA processes. Maximum likelihood estimation. Spectral analysis. Vector processes. Non-stationary time series. Long-memory processes.

TRG 880 Applied regression analysis 880
Academic organisation: Statistics
Contact time: 1 lpw
Period of presentation: Semester 1 or Semester 2
Language of tuition: English **Credits:** 30
Module content:
Introduction; simple linear regression; regression as linear model; matrices in regression; regression diagnostics: diagnostics for cases and variables; choosing a model; transforming the variables; nonlinear regression; logistic regression and related models; ridge regression; generalised linear models.

TST 890 Dissertation: Applied statistics 890
Academic organisation: Statistics
Period of presentation: Year
Language of tuition: English **Credits:** 240

TWS 890 Dissertation: Applied mathematics 890
Academic organisation: Mathematics and Applied Mathematics
Period of presentation: Year
Language of tuition: English **Credits:** 120

VBF 811 Consumer facilitation 811
Academic organisation: Consumer Science
Prerequisite: VBF 411 (Consumer facilitation) or similar subject and HSK 812 (Theoretical frameworks in Consumer studies)
Contact time: 30 hours per block session
Period of presentation: Semester 1
Language of tuition: English **Credits:** 30
Module content:
Focusing on consumer satisfaction, various aspects whereby the needs and wants of consumers may be met are addressed. Family decision-making, consumerism and consumer education also receive attention.

VBR 890 Dissertation: Consumer science 890
Academic organisation: Consumer Science
Period of presentation: Year
Language of tuition: Both Afr and Eng **Credits:** 150

VBR 892 Research report: Consumer science 892
Academic organisation: Consumer Science
Period of presentation: Year
Language of tuition: Both Afr and Eng **Credits:** 60

VDB 880 Menu planning 880
Academic organisation: Consumer Science
Prerequisite: VDS 322 and VDB 321 or similar subjects or appropriate and practical experience in food services
Contact time: 30 hours per block session
Period of presentation: Semester 1
Language of tuition: English **Credits:** 30
Module content:
Menu planning for different food service systems are studied, which includes the following topics:
- Client and management related factors to consider in menu planning.
- Principles and methods of menu planning.
- Menu planning for different client groups, cultures, occasions and types of food services.
- Evaluation criteria for menus of different food service systems.
- Computerised menu planning.

VDB 881 Quality management in food service systems 881
Academic organisation: Consumer Science
Prerequisite: VDB 410 or appropriate practical experience in food services
Contact time: 30 hours per block session
Period of presentation: Semester 2
Language of tuition: English **Credits:** 30
Module content:
The application of Total Quality Management in the various subsystems of the food

service system such as food procurement, food production, food safety and hygiene, food service is studied. The importance of developing, implementing and monitoring quality control systems in food services receive attention.

VDG 801 Electives: Nutrition 801
Academic organisation: Animal and Wildlife Sciences
Period of presentation: Year
Language of tuition: Both Afr and Eng **Credits:** 60
Module content:
Modules at the advanced level chosen in consultation with the Director of the Centre for Nutrition and the head of department. See list of modules below.

VDG 880 Contemporary aspects of nutrition 880
Academic organisation: Consumer Science
Prerequisite: Consult Head of Department
Contact time: 30 hours per block session
Period of presentation: Semester 2
Language of tuition: English **Credits:** 30
Module content:
The study of preventative nutritional care in the community. The emphasis is on preventative measures, programmes, training manuals and support measures as applied to life-cycle nutrition and malnutrition. An understanding of the multidisciplinary nature of public health will be developed.

VDG 881 Nutritional assessment and status 881
Academic organisation: Consumer Science
Prerequisite: Consult Head of Department
Contact time: 30 hours per block session
Period of presentation: Semester 2
Language of tuition: English **Credits:** 30
Module content:
Study of nutritional assessment to evaluate the nutritional status of individuals and populations. This will include topics such as:
• nutrition assessment methods;
• nutrition monitoring;
• nutrition survey methodology;
• computerised dietary analysis systems;
• application of nutritional assessment in disease prevention.

VDG 890 Dissertation: Nutrition 890
Academic organisation: Animal and Wildlife Sciences
Period of presentation: Year
Language of tuition: Both Afr and Eng **Credits:** 180

VDS 880 Social aspects of foods 880
Academic organisation: Consumer Science
Prerequisite: HSK 810 (Theoretical frameworks in cultural studies 810)
Contact time: 30 hours per block session
Period of presentation: Semester 2
Language of tuition: English **Credits:** 30
Module content:
The interaction between food and culture as well as factors influencing food habits and

food choice of various cultural and ethnic groups in South Africa will be studied. Sensory properties of food and techniques for measuring and modelling food choice and acceptability will receive attention.

VDS 881 Foods merchandising 881
Academic organisation: Consumer Science
Prerequisite: BEM 781 (Marketing Management)
Contact time: 30 hours per block session
Period of presentation: Semester 2
Language of tuition: English **Credits:** 30
Module content:
The South African food retail industry, including traditional and developing/new marketing channels. Analysis and evaluation of the present situation in the South African food retail industry. In-depth study of developing forms of retailing and marketing in the food industry in South Africa with emphasis on the informal sector and direct marketing.

VDS 883 Consumer aspects of food product design and development 883
Academic organisation: Consumer Science
Prerequisite: HSK 812 (Theoretical frameworks in consumer studies)
Contact time: 30 hours per block session
Period of presentation: Semester 2
Language of tuition: English **Credits:** 30
Module content:
Factors to consider when designing and developing food products for human consumption such as sensory attributes, socio-cultural, nutritional, lifestyle, economical, technological and convenience aspects will be addressed.

VGE 801 Monogastric nutrition 801
Academic organisation: Animal and Wildlife Sciences
Period of presentation: Year
Language of tuition: Both Afr and Eng **Credits:** 30
Module content:
Advanced study with specialisation in the nutrition of monogastric species for example poultry, dogs, pigs, aquaculture species, pets, cage birds, game birds and waterfowl as well as monogastric species in zoos and game breeding ranches. The study entails research, seminars and practical assignments.

VGE 802 Ruminant nutrition 802
Academic organisation: Animal and Wildlife Sciences
Period of presentation: Year
Language of tuition: Both Afr and Eng **Credits:** 30
Module content:
Advanced study of foregut and hindgut digestive processes and flow dynamics. Manipulation of digestion, end product metabolism, ad libitum and controlled feed intake. Energy, protein, mineral and vitamin requirements and standards for beef and dairy cattle, small stock and horses. Appropriate ration formulation. The study entails lectures, seminars, practical assignments and a research project with the results reported in a research paper.

VKD 800 Pig science 800
Academic organisation: Animal and Wildlife Sciences
Contact time: 1 dpw 1 lpw

Period of presentation: Year
Language of tuition: English **Credits:** 30
Module content:
Specialised study concerning pig production, considerations when planning pig production units, policy planning and market conditions. Production physiology, housing, nutritional management, breeding practices, diseases and hygiene. Products. Practical scientific and industry orientation through different assignments.

VKU 801 Animal science 801
Academic organisation: Animal and Wildlife Sciences
Contact time: 1 dpw 2 lpw
Period of presentation: Year
Language of tuition: Both Afr and Eng **Credits:** 120
Module content:
Consisting of a maximum of 120 credits of coursework selected from Animal Science modules on 800-level or other relevant modules.
VKU 890 Dissertation: Animal science 890
Academic organisation: Animal and Wildlife Sciences
Period of presentation: Year
Language of tuition: Both Afr and Eng **Credits:** 120
Module content:
Dissertation of 240 credits or a mini-dissertation of 120 credits.

VLE 801 Meat science 801
Academic organisation: Animal and Wildlife Sciences
Period of presentation: Year
Language of tuition: Both Afr and Eng **Credits:** 30
Module content:
Advanced study of carcass and meat quality characteristics as influenced by breeding, nutrition, physiology, growth and development as well as treatment and processing technology. Cattle, sheep, goats, pigs, poultry and game. Processing. Saleability, marketing methods, consumer profiles. Organisation and legislation.

VLE 802 Meat science 802
Academic organisation: Animal and Wildlife Sciences
Period of presentation: Year
Language of tuition: Both Afr and Eng **Credits:** 30
Module content:
Meat quality control from the farm to the retail distribution counter, processing and packaging. Intensive and extensive meat production units, abattoirs, wholesale and retail trade. Nutritional value of meat and meat products. The module consists of lectures, discussion groups, seminars and an industry-orientated research project with the results presented in a research paper.

VNE 800 Livestock ecology 800
Academic organisation: Animal and Wildlife Sciences
Contact time: 1 lpw 1 dpw
Period of presentation: Year
Language of tuition: English **Credits:** 30
Module content:
The study of animal-environment and genotype-environment interactions and the impact on natural resources. Adaptational mechanisms of breeds and species. The formulation

of optimal farming systems with respect to adaptation. The determination of biological outputs and the classification of animal breeds and species in terms of biological traits. Research and study assignments are executed taking the academic needs of the candidates into consideration.

WDE 800 Pasture science 800
Academic organisation: Plant Production and Soil Science
Contact time: 1 ppw
Period of presentation: Year
Language of tuition: Both Afr and Eng **Credits:** 80
Module content:
Any module and/or assignment(s) at the advanced level chosen in consultation with the head of department.

WDE 801 Advanced coursework 801
Academic organisation: Plant Production and Soil Science
Contact time: 1 ppw
Period of presentation: Year
Language of tuition: Both Afr and Eng **Credits:** 120
Module content:
Any module and/or assignment(s) at the advanced level chosen in consultation with the head of department.

WDE 890 Dissertation: Pasture science 890
Academic organisation: Plant Production and Soil Science
Period of presentation: Year
Language of tuition: Both Afr and Eng **Credits:** 160
Module content:
Each candidate must write a dissertation on his/her research project in Pasture science and at least prepare a concept research paper for publication in a peer-reviewed scientific journal.

WDE 891 Mini-dissertation: Pasture science 891
Academic organisation: Plant Production and Soil Science
Period of presentation: Year
Language of tuition: Both Afr and Eng **Credits:** 120
Module content:
Each candidate must write a dissertation on his/her research project in Pasture Science and at least prepare a concept research paper for publication in a peer-reviewed scientific journal.

WIS 890 Dissertation: Mathematics 890
Academic organisation: Mathematics and Applied Mathematics
Period of presentation: Year
Language of tuition: English **Credits:** 120

WLK 800 Wool science 800
Academic organisation: Animal and Wildlife Sciences
Contact time: 1 dpw 1 lpw
Period of presentation: Year
Language of tuition: English **Credits:** 30

Module content:
Discussions and literature studies on advanced subjects concerning wool and fibre. Factors influencing wool and mohair production. The influence of environment, nutrition and breeding on the chemical and physical composition of wool and mohair. Factors influencing classing, processing and marketing of wool. Discussions and seminars on techniques in quantifying physical and chemical characteristics of wool and mohair, relevant literature and research techniques. Evaluation of variation in skin and fibre.

WTW 812 Mathematics 812
Academic organisation: Mathematics and Applied Mathematics
Prerequisite: Topology, Measure theory and Functional analysis on honours level
Contact time: 1 lpw
Period of presentation: Semester 2
Language of tuition: English **Credits:** 40
Module content:
*Consult with the Head of the Department of Mathematics and Applied Mathematics about the availability of this master's module in a particular year.
Filters. Convergence of filters, sequences and nets in a topological space. Convergence structures, basic properties and constructs. Continuous convergence, c-embedded convergence spaces. Order convergence on lattices and posets. Convergence vector spaces and completions. Continuous convergence and duality on locally convex spaces. The Hahn-Banach theorem in convergence spaces.

WTW 820 Mathematical morphology 820
Academic organisation: Mathematics and Applied Mathematics
Prerequisite: Measure theory and Functional analysis on honours level
Contact time: 1 lpw
Period of presentation: Semester 1
Language of tuition: English **Credits:** 40
Module content:
Mathematical morphology – a theory for the analysis of special structures and a powerful methodology for the extraction of useful information from images. Morphological operators and their properties: erosion, dilation, opening, closing, granulometries. Applications to noise removal, filtering, extraction of features, edge detection, etc. LULU operators – properties and applications. Partial differential equations for morphological operators.

WTW 831 Mathematical and computational finance 831
Academic organisation: Mathematics and Applied Mathematics
Prerequisite: Financial Engineering on honours level
Contact time: 1 lpw
Period of presentation: Semester 1
Language of tuition: English **Credits:** 40
Module content:
*Consult with the Head of the Department of Mathematics and Applied Mathematics about the availability of this master's module in a particular year.
Stochastic calculus: Multidimensional Itô formula, correlated Wiener processes, the infinitesimal operator, SDE's, PDE's, the Kolmogorov equations, martingales, stochastic integral representations and Gisanov's theorem. The Martingale approach to arbitrage theory. Bonds and interest rates: Martingale models, standard models, the Heath-Jarrow-Morton framework. Monte Carlo methods. Finite difference methods.

WTW 832 Advanced methods of financial engineering 832
Academic organisation: Mathematics and Applied Mathematics
Prerequisite: Financial Engineering on honours level
Contact time: 3 lpw
Period of presentation: Year
Language of tuition: English **Credits:** 40
Module content:
*Consult with the Head of the Department of Mathematics and Applied Mathematics about the availability of this master's module in a particular year.
Interest rate derivatives. Stochastic volatility models. Models to improve on the flaws in the Black-Scholes model. Principles of deal structuring. Principles of mathematical models. Specialised methods for interest rate and exotic derivatives. Application of numerical methods to relevant practical problems.

WTW 833 Quantitative risk management 833
Academic organisation: Mathematics and Applied Mathematics
Prerequisite: Financial Engineering on honours level
Contact time: 3 lpw
Period of presentation: Year
Language of tuition: English **Credits:** 40
Module content:
*Consult with the Head of the Department of Mathematics and Applied Mathematics about the availability of this master's module in a particular year.
Risk in perspective. Traditional RiskMetrics. Methods to calculate VaR. Designing scenario analyses and stress analysis. Risk measures based on loss distributions. Aggregate risk measures which include coherent risk measures. Extreme value theory. Correlation, copulas and dependence. Credit risk management.

WTW 836 Homogenisation of partial differential equations 836
Academic organisation: Mathematics and Applied Mathematics
Prerequisites: Functional analysis, Measure theory, Partial differential equations at honours level
Contact time: 1 lecture per week (2 hours duration)
Period of presentation: Semester 1 or Semester 2
Language of tuition: English **Credits:** 40
Module content:
* Consult with the Head of the Department of Mathematics and Applied Mathematics about the availability of this master's module in a particular year.
Review of functional analysis, Sobolev spaces and variational problems; rapidly oscillating function; periodic composite materials; homogenisation of elliptic problems; multiple scale method; two-scale convergence and applications.

WTW 840 Special functions and approximation theory 840
Academic organisation: Mathematics and Applied Mathematics
Prerequisites: Complex Analysis at 3rd-year level; Advanced Calculus and Ordinary Differential equations (ODEs)
Contact time: 1 lpw (2 hours duration)
Period of presentation: Semester 1 or Semester 2
Language of tuition: English **Credits:** 40
Module content:
* Consult with the Head of the Department of Mathematics and Applied Mathematics about the availability of this master's module in a particular year.

The Gamma and Beta functions, the hypergeometric function, orthogonal polynomials and their properties, classical orthogonal polynomials such as Chebychev, Hermite, Laguerre, Ultraspherical and Jacobi polynomials, Padé approximation, applications of zeros of orthogonal polynomials to convergence of Padé approximants.

WTW 846 Stochastic partial differential equations 846
Academic organisation: Mathematics and Applied Mathematics
Prerequisites: Functional analysis, Measure theory, Partial differential equations at honours level. Knowledge of Probability theory is advised but not required.
Contact time: 1 lpw (2 hours duration)
Period of presentation: Semester 1 or Semester 2
Language of tuition: English **Credits:** 40
Module content:
* Consult with the Head of the Department of Mathematics and Applied Mathematics about the availability of this master's module in a particular year.
Generalities on probability theory (random variables, conditional expectations); Martingales; stochastic integrals; Markov processes; existence and uniqueness results for ordinary stochastic differential equations; Sobolev spaces, Aubin-Dubinsky-Simon compactness theorem; convergence of probability measures: Prokhorov and Skorokhod theorems; existence and uniqueness of solutions of stochastic parabolic equations in divergence form: The Galerkin scheme; idea of renormalization group theory in turbulent flows modelled by Navier-Stokes equations with random forcing.

WTW 850 Mathematical epidemiology 850
Academic organisation: Mathematics and Applied Mathematics
Prerequisites: Dynamical systems, Ordinary differential equations (ODEs)
Contact time: 1 lpw (2 hours duration)
Period of presentation: Semester 1 or Semester 2
Language of tuition: English **Credits:** 40
Module content:
* Consult with the Head of the Department of Mathematics and Applied Mathematics about the availability of this master's module in a particular year.
The spread of infections is modelled via dynamical systems defined by sets of differential equations. Compartmental models of the spread of contagious infection (e.g. MSEIR) and models of vector borne diseases are considered. Methods of analysis of the local and global asymptotic stability of the disease free and endemic equilibria and their characterization in terms of the basic reproduction number. Reliable numerical simulations and sensitivity analysis with respect to the parameters of the models.

WTW 851 Introduction to categories and sheaves 851
Academic organisation: Mathematics and Applied Mathematics
Prerequisites: Algebra at 3rd-year and honours levels
Contact time: 1 lpw (2 hours duration)
Period of presentation: Semester 1 or Semester 2
Language of tuition: English **Credits:** 40
Module content:
* Consult with the Head of the Department of Mathematics and Applied Mathematics about the availability of this master's module in a particular year.
The language of categories; limits; additive and abelian categories; abelian sheaves; cohomology of sheaves; homotopy and fundamental groupoid.

WTW 855 Lattice theory 855
Academic organisation: Mathematics and Applied Mathematics
Prerequisites: Algebra at 3rd-year level
Contact time: 1 lpw (2 hours duration)
Period of presentation: Semester 1 or Semester 2
Language of tuition: English **Credits:** 40
Module content:
* Consult with the Head of the Department of Mathematics and Applied Mathematics about the availability of this master's module in a particular year.
The following topics will be studies: Ordered sets; down-sets of ordered sets; lattices and complete lattices; modular, distributive and Boolean lattices (as algebras and as ordered sets); the representation of lattices by collections of sets; the lattice of congruences of a lattice; complete partially ordered sets and fixed point theorems and maximality principles.

WTW 863 Finite element analysis 863
Academic organisation: Mathematics and Applied Mathematics
Prerequisites: Finite element method and Functional analysis at honours level
Contact time: 1 lpw (2 hours duration)
Period of presentation: Semester 1 or Semester 2
Language of tuition: English **Credits:** 40
Module content:
* Consult with the Head of the Department of Mathematics and Applied Mathematics about the availability of this master's module in a particular year.
Finite element interpolation theory. Finite element approximation of elliptic boundary value problems and eigenvalue problems. Finite element approximation of parabolic and hyperbolic initial value problems. Applications in a project.

WTW 865 Graph theory 865
Academic organisation: Mathematics and Applied Mathematics
Prerequisites: Discrete Structures at 3rd-year level
Contact time: 1 lpw (2 hours duration)
Period of presentation: Semester 1 or Semester 2
Language of tuition: English **Credits:** 40
Module content:
*Consult with the Head of the Department of Mathematics and Applied Mathematics about the availability of this master's module in a particular year.
The basics (including a variety of topics); matchings; connectivity; planarity; colourings and generalised colourings and hereditary properties of graphs.

WTW 866 Hyperbolic systems of partial differential equations 866
Academic organisation: Mathematics and Applied Mathematics
Prerequisites: Partial differential equations at 3rd-year and hons level; Adv calculus and Linear algebra
Contact time: 1 lpw (2 hours duration)
Period of presentation: Semester 1 or Semester 2
Language of tuition: English **Credits:** 40
Module content:
*Consult with the Head of the Department of Mathematics and Applied Mathematics about the availability of this master's module in a particular year.
Systems of first order partial differential equations and their relationship to wave phenomena. The module will show that the traditional wave equation is over-rated as

study material. More detailed contents: Hyperbolicity of first order systems (linear and nonlinear); characteristic curves and surfaces; domains of influence and dependence; well-posedness of initial and boundary value problems; shock phenomena; numerical calculation of solutions; application to the equations of compressible gas dynamics and Maxwell's equations for electromagnetism.

WTW 869 Differential geometry 869
Academic organisation: Mathematics and Applied Mathematics
Prerequisites: Linear algebra, Differential and Integral calculus, Partial differential equations at honours level
Contact time: 1 lpw (2 hours duration)
Period of presentation: Semester 1 or Semester 2
Language of tuition: English **Credits:** 40
Module content:
*Consult with the Head of the Department of Mathematics and Applied Mathematics about the availability of this master's module in a particular year.
Differentiable manifolds; multilinear algebra; exterior differential calculus; integration of differential forms and De Rham cohomology; connections on frame bundles; Riemannian manifolds and submanifolds; second fundamental form; harmonic mappings between Riemannian manifolds.

WTW 880 Sobolev spaces 880
Academic organisation: Mathematics and Applied Mathematics
Prerequisite: Measure theory, Differential equations and Functional analysis on honours level
Contact time: 1 lpw
Period of presentation: Semester 1
Language of tuition: English **Credits:** 40
Module content:
*Consult with the Head of Department of Mathematics and Applied Mathematics about the availability of this master's module in a particular year.
The module focuses on the Hilbertion Sobolev spaces as well as to their applications to elliptic boundary value problems. Topics to be discussed include: Distributions; Sobolev spaces of positive and negative integer orders; Sobolev spaces of traces; Embeddings of Sobolev spaces; Boundary value problems.

WTW 881 Abstract analysis 881
Academic organisation: Mathematics and Applied Mathematics
Prerequisite: Measure theory and Functional analysis on honours level
Contact time: 1 lpw
Period of presentation: Semester 1
Language of tuition: English **Credits:** 40
Module content:
*Consult with the Head of the Department of Mathematics and Applied Mathematics about the availability of this master's module in a particular year.
Capita selecta from the following: Duality theory. Weak and Weak* topologies. The Krein-Milman theorem. The Stone-Weierstrass theorem. Fixed point theorems. Banach Algebras and the Gelfand transform. C*-algebras and their representations. Semigroups of operators. Functional analysis applied to probability theory and stochastics.

WTW 884 Advanced measure theory 884
Academic organisation: Mathematics and Applied Mathematics

Prerequisite: Measure Theory and Functional Analysis on honours level
Contact time: 1 lpw
Period of presentation: Semester 2
Language of tuition: English **Credits:** 40
Module content:
*Consult with the Head of the Department of Mathematics and Applied Mathematics about the availability of this master's module in a particular year.
Lebesgue integral in a general measure space: Basic properties, convergence theorems, convergence in measure. Lebesgue spaces: Completeness, approximation by continuous functions. Complex measures: Absolute continuity, Random-Nikodym Theorem, representation of bounded linear functionals on Lebesgue spaces, Riesz Representation Theorem for bounded linear functionals on the space of continuous functions on a locally convergent Hausdorff space where X is a locally compact Hausdorff space. Applications to probability.

WTW 886 Mathematics 886
Academic organisation: Mathematics and Applied Mathematics
Contact time: 1 lpw
Period of presentation: Semester 1
Language of tuition: English **Credits:** 40
Module content:
*Consult with the Head of the Department of Mathematics and Applied Mathematics about the availability of this master's module in a particular year.
Refer to the Department regarding the module content.

WTW 887 Dynamical systems 887
Academic organisation: Mathematics and Applied Mathematics
Prerequisite: Functional analysis, Partial differential equations and Finite element method at honours level
Contact time: 1 lpw
Period of presentation: Semester 1
Language of tuition: English **Credits:** 40
Module content:
*Consult with the Head of the Department of Mathematics and Applied Mathematics about the availability of this master's module in a particular year.
Finite dimensional dynamical systems: Autonomous and non-autonomous systems of differential equations, dynamical systems, linear and nonlinear systems, existence and uniqueness of solutions, extension of solutions, maximal solution and maximal interval of existence, phase space and phase portrait. Stability theory for equilibria and periodic orbits using linear approximation, Liapunov's method and other energy methods and discrete dynamical systems (Poincarè map). Introduction to strange attractors. Application to mechanics and population models. Infinite dimensional dynamical systems: Semigroups, first and second order abstract differential equations, Sobolev spaces, finite dimensional approximation. Application to heat conduction and mechanical vibration. Examples of nonlinear systems.

WTW 888 Special topics in mathematics 888
Academic organisation: Mathematics and Applied Mathematics
Prerequisites:
Contact time: 1 lpw (2 hours duration)
Period of presentation: Semester 1 or Semester 2
Language of tuition: English **Credits:** 40

Module content:
Content will vary from time to time depending on the availability of expertise in the Department.

WTW 889 Mathematics 889
Academic organisation: Mathematics and Applied Mathematics
Contact time: 1 lpw
Period of presentation: Semester 1
Language of tuition: English **Credits:** 40
Module content:
*Consult with the Head of the Department of Mathematics and Applied Mathematics about the availability of this master's module in a particular year.
Refer to the Department regarding the module content.

WTW 890 Magister oral 890
Academic organisation: Mathematics and Applied Mathematics
Period of presentation: Year
Language of tuition: Both Afr and Eng

WTW 892 Dissertation: Mathematics of finance 892
Academic organisation: Mathematics and Applied Mathematics
Period of presentation: Year
Language of tuition: English **Credits:** 120

WTW 893 Dissertation: Mathematics education 893
Academic organisation: Mathematics and Applied Mathematics
Period of presentation: Year
Language of tuition: English **Credits:** 80

WTW 894 Dissertation: Financial engineering 894
Academic organisation: Mathematics and Applied Mathematics
Period of presentation: Year
Language of tuition: English **Credits:** 120

ZEN 808 Conservation planning and monitoring 808
Academic organisation: Zoology and Entomology
Contact time: 4 dpw
Period of presentation: Year
Language of tuition: English **Credits:** 30
Module content:
Biodiversity survey techniques; data and information management; data assessment; principles of data extrapolation; inventories; biodiversity risk assessment (PHVA, small and declining population paradigms, prioritisation); principles of reserve selection; surrogacy; reserve design; integrated land-use planning.
Landscape theories and models (hierarchy, percolation, metapopulation, source-sink); scaling patterns and processes across landscapes (patches, corridors, mosaics and flows); emerging patterns and processes; principles of landscape dynamics; principles of landscape conservation, management and design (transformation, fragmentation); methods in landscape ecology (numerical and spatial data processing, fractal geometry approach, GIS, remote sensing, GPS, spatially explicit population models).
Skills: GradSect, Access, Excel, Visual Basic, GIS (Arc View) reserve selection algorithms.

ZEN 809 Biogeography and macro-ecology 809
Academic organisation: Zoology and Entomology
Contact time: 4 dpw
Period of presentation: Year
Language of tuition: English **Credits:** 30
Module content:
Biogeographic consequences of plate tectonics, Pleistocene southern African climatic, geological, edaphic and geomorphological patterns. Reconstructing biogeographic histories (speciation, extinction, dispersal, vicariance, endemism, provincialism and disjunction); phytogeographical patterns, biomes, vegetation types. Methodological issues in macro-ecology; patterns of body size, abundance and energetics; geographic range sizes; species dynamics in landscapes; implications of macro-ecological patterns to ecology; biogeography and evolution; macro-ecological perspectives on conservation: species richness, hierarchical diversity, hotspots, spatial and temporal patterns in diversity (genetic, taxonomic, functional); causal mechanisms, species diversity, biodiversity and global change.

ZEN 811 Conservation and development 811
Academic organisation: Zoology and Entomology
Contact time: 4 dpw
Period of presentation: Year
Language of tuition: English **Credits:** 30
Module content:
An international perspective on human resource utilisation and its global effects. The problems of implementing conservation measures in the face of human development. Conservation as an economic process.

ZEN 872 Populations and communities: Spatial and temporal variability 872
Academic organisation: Zoology and Entomology
Contact time: 4 dpw
Period of presentation: Year
Language of tuition: English **Credits:** 30
Module content:
Demography with emphasis on forces affecting population growth rate and regulation; competition and facilitation within and between populations; risk and risk assessment; temporal trends and extinction; management, harvesting and control with emphasis on illustrating principles using studies conducted in Africa.
Structure, composition and function of communities with emphasis on factors affecting resilience, resistance and persistence; temporal variability with emphasis on the influences of foodwebs structure and environmental variability; spatial pattern analysis; species-abundance relations; species affinities; community classification.

ZEN 875 Conservation in practice 875
Academic organisation: Zoology and Entomology
Contact time: 4 dpw 1 other per week
Period of presentation: Year
Language of tuition: English **Credits:** 30
Module content:
Conceptual issues in the management of small populations; captive propagation; control of invasive species; control of problem populations; restoration of species and communities; conservation education, and involvement of local communities in conservation programmes; monitoring techniques and data handling; design and

interpretation of laboratory and field experiments to solve ecological and conservation problems.

ZEN 891 Research project 891
Academic organisation: Zoology and Entomology
Period of presentation: Year
Language of tuition: English **Credits:** 120
Module content:
Research projects may be based either on fieldwork, laboratory work, experiments or the analysis of existing data sets. This decision must be taken in consultation with the candidate's designated project supervisor. The choice of project topic will be determined to a very large extent by the time available for data collection and analysis.
Students should select and approach a potential supervisor based on their own interests and that of the supervisors. A list of projects may be made available, although the students may choose their own project as long as a supervisor agrees to it. Joint supervision of projects by more than one person at the University, or one person from outside the University, is also possible.
The purpose of the research project is to provide students with a thorough grounding in the planning, execution, analysis and scientific writing stages of a research project. Students must complete the background reading, design the objectives and perform the observations and/or experiments pertaining to the chosen project, as well as the analysis and compilation of the results and discussion in the form of a scientific publication. The project should be formatted for submission to a scientific journal.

ZOO 890 Dissertation: Zoology 890
Academic organisation: Zoology and Entomology
Period of presentation: Year
Language of tuition: English **Credits:** 240

AGR 900 Agronomy 900
Academic organisation: Plant Production and Soil Science
Period of presentation: Year
Language of tuition: Both Afr and Eng **Credits:** 60
Module content:
Study and discussion of topical research results from recent scientific publications.
Examination/Presentation on the thesis

AGR 990 Thesis: Agronomy 990
Academic organisation: Plant Production and Soil Science
Period of presentation: Year
Language of tuition: Both Afr and Eng **Credits:** 300
Module content:
Each candidate must write a thesis on his/her research project in Agronomy and have at least one research paper published in a peer-reviewed scientific journal, based on the work from the thesis.

AGV 900 Agrarian extension 900
Academic organisation: Agricultural Economics, Extension and Rural Development
Period of presentation: Year
Language of tuition: Both Afr and Eng **Credits:** 1

AGV 990 Thesis: Agrarian extension 990
Academic organisation: Agricultural Economics, Extension and Rural Development
Period of presentation: Year
Language of tuition: Both Afr and Eng **Credits:** 360

APZ 900 Animal production 900
Academic organisation: Animal and Wildlife Sciences
Period of presentation: Year
Language of tuition: English **Credits:** 1

APZ 990 Thesis: Animal production 990
Academic organisation: Animal and Wildlife Sciences
Period of presentation: Year
Language of tuition: English **Credits:** 360

AWM 900 Meteorology 900
Academic organisation: Geography, Geoinformatics and Meteorology
Period of presentation: Year
Language of tuition: Both Afr and Eng **Credits:** 1

AWM 990 Thesis: Meteorology 990
Academic organisation: Geography, Geoinformatics and Meteorology
Period of presentation: Year
Language of tuition: Both Afr and Eng **Credits:** 480

BCM 901 Trends in biochemical research 901
Academic organisation: Biochemistry
Contact time: 1 dpw
Period of presentation: Year
Language of tuition: English **Credits:** 18
Module content:
Study and discussion of topical research results from recent scientific publications.

BCM 990 Project and thesis 990
Academic organisation: Biochemistry
Period of presentation: Year
Language of tuition: English **Credits:** 342

BIF 901 Trends in bioinformatics research 901
Academic organisation: Biochemistry
Contact time: 1 dpw
Period of presentation: Year
Language of tuition: English **Credits:** 18

BIF 990 Thesis: Bioinformatics 990
Academic organisation: Biochemistry
Period of presentation: Year
Language of tuition: English **Credits:** 302

BOT 900 Plant science 900
Academic organisation: Plant Science
Period of presentation: Year
Language of tuition: Both Afr and Eng **Credits:** 1

BOT 990 Thesis: Plant science 990
Academic organisation: Plant Scienc
Period of presentation: Year
Language of tuition: Both Afr and Eng **Credits:** 360

CHM 900 Chemistry 900
Academic organisation: Chemistry
Period of presentation: Year
Language of tuition: Both Afr and Eng **Credits:** 1

CHM 990 Thesis: Chemistry 990
Academic organisation: Chemistry
Period of presentation: Year
Language of tuition: Both Afr and Eng **Credits:** 360

DPL 900 Rural development planning 900
Academic organisation: Agricultural Economics, Extension and Rural Development
Period of presentation: Year
Language of tuition: English **Credits:** 1

DPL 990 Thesis: Rural development planning 990
Academic organisation: Agricultural Economics, Extension and Rural Development
Period of presentation: Year
Language of tuition: English **Credits:** 360

EGF 900 Exploration geophysics 900
Academic organisation: Geology
Period of presentation: Year
Language of tuition: Both Afr and Eng **Credits:** 1

EGF 990 Thesis: Exploration geophysics 990
Academic organisation: Geology
Period of presentation: Year
Language of tuition: Both Afr and Eng **Credits:** 480

ENT 900 Entomology 900
Academic organisation: Zoology and Entomology
Period of presentation: Year
Language of tuition: English **Credits:** 1

ENT 990 Thesis: Entomology 990
Academic organisation: Zoology and Entomology
Period of presentation: Year
Language of tuition: English **Credits:** 360

ENV 900 Examination: Environment and society 900
Academic organisation: Geography, Geoinformatics and Meteorology
Period of presentation: Year
Language of tuition: Both Afr and Eng **Credits:** 1
Module content:
Examination/Presentation on the thesis

ENV 990 Thesis: Water resource management 990
Academic organisation: Microbiology and Plant Pathology
Period of presentation: Year
Language of tuition: English **Credits:** 360

ENV 991 Thesis: Environment and society 991
Academic organisation: Zoology and Entomology
Period of presentation: Year
Language of tuition: English **Credits:** 360

ENV 992 Thesis: Environmental ecology 992
Academic organisation: Zoology and Entomology
Period of presentation: Year
Language of tuition: English **Credits:** 360

ENV 993 Thesis: Environmental economics 993
Academic organisation: Agricultural Economics, Extension and Rural Development
Period of presentation: Year
Language of tuition: English **Credits:** 360

ENV 994 Thesis: Environmental management 994
Academic organisation: Zoology and Entomology
Period of presentation: Year
Language of tuition: English **Credits:** 360

ENV 998 Thesis: Air quality management 998
Academic organisation: Geography, Geoinformatics and Meteorology
Period of presentation: Year
Language of tuition: English **Credits:** 360

FOR 990 Forest science 990
Academic organisation: Plant Production and Soil Science
Period of presentation: Year
Language of tuition: English **Credits:** 360
Module content:
*Interdepartmental programme. The curriculum is determined by the heads of department in the biological sciences and will include the research proposal development and scientific writing. This is followed by research in the area of the chosen specialisation in Forest Science culminating in the preparation and submission of research dissertation: including submission of scientific papers for peer reviewed credited journals.

FSK 900 Physics 900
Academic organisation: Physics
Period of presentation: Year
Language of tuition: Both Afr and Eng **Credits:** 1

FSK 990 Thesis: Physics 990
Academic organisation: Physics
Period of presentation: Year
Language of tuition: Both Afr and Eng **Credits:** 360

FST 901 Examination: Food science 901
Academic organisation: Food Science
Period of presentation: Year
Language of tuition: English **Credits:** 40

FST 990 Thesis: Food science 990
Academic organisation: Food Science
Period of presentation: Year
Language of tuition: English **Credits:** 360

GDK 900 Soil science 900
Academic organisation: Plant Production and Soil Science
Period of presentation: Year
Language of tuition: Both Afr and Eng **Credits:** 60
Module content:
Study and discussion of topical research results from recent scientific publications. Examination/Presentation on the thesis

GDK 990 Thesis: Soil science 990
Academic organisation: Plant Production and Soil Science
Period of presentation: Year
Language of tuition: Both Afr and Eng **Credits:** 300
Module content:
Each candidate must write a thesis on his/her research project in Soil science and have at least one research paper published in a peer-reviewed scientific journal, based on the work from the thesis.

GGF 900 Examination: Geography 900
Academic organisation: Geography, Geoinformatics and Meteorology
Period of presentation: Year
Language of tuition: Both Afr and Eng **Credits:** 1

GGF 990 Thesis: Geography 990
Academic organisation: Geography, Geoinformatics and Meteorology
Period of presentation: Year
Language of tuition: Both Afr and Eng **Credits:** 480

GIS 900 Examination: Geoinformatics 900
Academic organisation: Geography, Geoinformatics and Meteorology
Period of presentation: Year
Language of tuition: Both Afr and Eng **Credits:** 1

GIS 990 Thesis: Geoinformatics 990
Academic organisation: Geography, Geoinformatics and Meteorology
Period of presentation: Year
Language of tuition: Both Afr and Eng **Credits:** 480

GLG 900 Geology 900
Academic organisation: Geology
Period of presentation: Year
Language of tuition: Both Afr and Eng **Credits:** 1

GLG 990 Thesis: Geology 990
Academic organisation: Geology
Period of presentation: Year
Language of tuition: Both Afr and Eng **Credits:** 360

GTK 900 Genetics 900
Academic organisation: Genetics
Period of presentation: Year
Language of tuition: English **Credits:** 1

GTK 990 Thesis: Genetics 990
Academic organisation: Genetics
Period of presentation: Year
Language of tuition: English **Credits:** 360

IGL 990 Thesis: Engineering geology 990
Academic organisation: Geology
Period of presentation: Year
Language of tuition: Both Afr and Eng **Credits:** 360

LDV 900 Thesis: Land development 900
Academic organisation: Agricultural Economics, Extension and Rural Development
Period of presentation: Year
Language of tuition: Both Afr and Eng **Credits:** 1

LDV 990 Land development 990
Academic organisation: Agricultural Economics, Extension and Rural Development
Period of presentation: Year
Language of tuition: Both Afr and Eng **Credits:** 360

LEK 900 Agricultural economics 900
Academic organisation: Agricultural Economics, Extension and Rural Development
Period of presentation: Year
Language of tuition: Both Afr and Eng **Credits:** 80

LEK 990 Thesis: Agricultural economics 990
Academic organisation: Agricultural Economics, Extension and Rural Development
Period of presentation: Year
Language of tuition: Both Afr and Eng **Credits:** 480

MBY 900 Microbiology 900
Academic organisation: Microbiology and Plant Pathology
Period of presentation: Year
Language of tuition: Both Afr and Eng **Credits:** 1

MBY 990 Thesis: Microbiology 990
Academic organisation: Microbiology and Plant Pathology
Period of presentation: Year
Language of tuition: Both Afr and Eng **Credits:** 360

MPS 900 Medicinal plant science 900
Academic organisation: Plant Science

Period of presentation: Year
Language of tuition: Both Afr and Eng

MPS 990 Thesis: Medicinal plant science 990
Academic organisation: Plant Science
Period of presentation: Year
Language of tuition: English **Credits:** 360

NLB 900 Wildlife management 900
Academic organisation: Animal and Wildlife Sciences
Period of presentation: Year
Language of tuition: Both Afr and Eng **Credits:** 1

NLB 990 Thesis: Wildlife management 990
Academic organisation: Animal and Wildlife Sciences
Period of presentation: Year
Language of tuition: Both Afr and Eng **Credits:** 360

PLQ 900 Plant quarantine 900
Academic organisation: Microbiology and Plant Pathology
Period of presentation: Year
Language of tuition: English **Credits:** 50

PLQ 990 Thesis: Plant quarantine 990
Academic organisation: Microbiology and Plant Pathology
Period of presentation: Year
Language of tuition: Both Afr and Eng **Credits:** 350

PPT 900 Plant pathology 900
Academic organisation: Microbiology and Plant Pathology
Period of presentation: Year
Language of tuition: Both Afr and Eng **Credits:** 50

PPT 990 Thesis: Plant pathology 990
Academic organisation: Microbiology and Plant Pathology
Period of presentation: Year
Language of tuition: Both Afr and Eng **Credits:** 350

SCE 900 Examination: Science education 900
Academic organisation: Centre for Science Development
Period of presentation: Year
Language of tuition: Both Afr and Eng **Credits:** 1

SCE 990 Thesis: Science education 990
Academic organisation: Centre for Science Development
Period of presentation: Year
Language of tuition: Both Afr and Eng **Credits:** 360

TBK 900 Horticultural science 900
Academic organisation: Plant Production and Soil Science
Period of presentation: Year
Language of tuition: Both Afr and Eng **Credits:** 60

Module content:
Study and discussion of topical research results from recent scientific publications. Examination/presentation on the thesis.

TBK 990 Thesis: Horticultural science 990
Academic organisation: Plant Production and Soil Science
Period of presentation: Year
Language of tuition: Both Afr and Eng **Credits:** 300
Module content:
Each candidate must write a thesis on his/her research project in Horticulture and have at least one research paper published in a peer-reviewed scientific journal, based on the work from the thesis.

TST 990 Thesis: Applied statistics 990
Academic organisation: Statistics
Period of presentation: Year
Language of tuition: English **Credits:** 480

TWS 990 Thesis: Applied mathematics 990
Academic organisation: Mathematics and Applied Mathematics
Period of presentation: Year
Language of tuition: Both Afr and Eng **Credits:** 360

VBR 900 Consumer science 900
Academic organisation: Consumer Science
Period of presentation: Year
Language of tuition: Both Afr and Eng **Credits:** 1

VBR 990 Thesis: Consumer science 990
Academic organisation: Consumer Science
Period of presentation: Year
Language of tuition: Both Afr and Eng **Credits:** 360

VDG 900 Oral examination: Nutrition 900
Academic organisation: Animal and Wildlife Sciences
Period of presentation: Year
Language of tuition: Both Afr and Eng **Credits:** 1

VDG 990 Thesis: Nutrition 990
Academic organisation: Animal and Wildlife Sciences
Period of presentation: Year
Language of tuition: Both Afr and Eng **Credits:** 480

VKU 900 Animal science 900
Academic organisation: Animal and Wildlife Sciences
Period of presentation: Year
Language of tuition: Both Afr and Eng **Credits:** 1

VKU 990 Thesis: Animal science 990
Academic organisation: Animal and Wildlife Sciences
Period of presentation: Year
Language of tuition: Both Afr and Eng **Credits:** 360

WDE 900 Pasture science 900
Academic organisation: Plant Production and Soil Science
Period of presentation: Year
Language of tuition: Both Afr and Eng **Credits:** 60
Module content:
Study and discussion of topical research results from recent scientific publications. Examination/presentation on the thesis.

WDE 990 Thesis: Pasture science 990
Academic organisation: Plant Production and Soil Science
Period of presentation: Year
Language of tuition: Both Afr and Eng **Credits:** 300
Module content:
Each candidate must write a thesis on his/her research project in Pasture science and have at least one research paper published in a peer-reviewed scientific journal, based on the work from the thesis.

WIS 990 Thesis: Mathematics 990
Academic organisation: Mathematics and Applied Mathematics
Period of presentation: Year
Language of tuition: Both Afr and Eng **Credits:** 360

WTW 990 Doctoral oral 990
Academic organisation: Mathematics and Applied Mathematics
Period of presentation: Year
Language of tuition: Both Afr and Eng **Credits:** 360

WTW 993 Thesis: Mathematics education 993
Academic organisation: Mathematics and Applied Mathematics
Period of presentation: Year
Language of tuition: English **Credits:** 360

ZOO 900 Zoology 900
Academic organisation: Zoology and Entomology
Period of presentation: Year
Language of tuition: English **Credits:** 1

ZOO 990 Thesis: Zoology 990
Academic organisation: Zoology and Entomology
Period of presentation: Year
Language of tuition: English **Credits:** 360

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