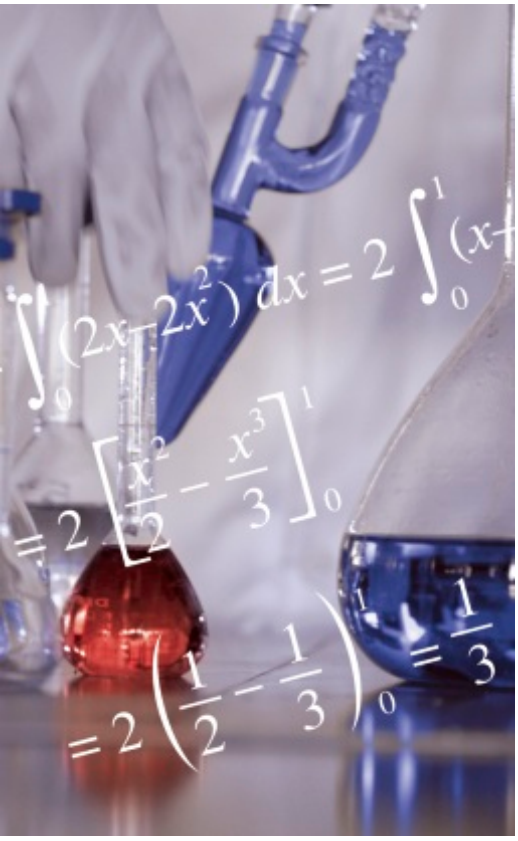
Report

05/06

Faculty of

Natural and Agricultural Sciences



Faculty of Natural and Agricultural Sciences
UNIVERSITEIT VAN DIE VRYSTAAT • UNIVERSITY OF THE FREE STATE • YUNIVESITHI YA FREISTATA

Report 05/06

Faculty of Natural and Agricultural Sciences

Issued by:
Faculty of Natural and Agricultural Sciences,
University of the Free State

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Language revision
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Revision of bibliographical data
Mercia Coetzee

Layout and cover design
Chrysalis advertising and publishing

Photographers
Gerhard Louw
Stephen Collett

Printing
Print 24

The Afrikaans version is also available on a compact disc
from the dean's office or on the university's website at
www.ufs.ac.za.

Cover page: Aspects of natural and agricultural sciences.

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Preface

From the Dean's office

Prof. Herman van Schalkwyk.

The Faculty of Natural and Agricultural Sciences at the University of the Free State (UFS) leads the way in the practising of natural and agricultural sciences in South Africa and the highest levels of quality and credibility are reflected.

Our commitment, however, reaches far beyond just this. It reaches beyond the borders of the country and across continents; its multi-disciplinary and practical approach is vested in all the disciplines presented by the faculty.

In 2005/06 the Faculty experienced significant growth in measurable outputs. A contributing factor was the comprehensive apparatus strategy and plan which was implemented in 2005. With this strategy, university funds were used to leverage other funds in order to obtain huge discounts from suppliers of apparatus. In this way the faculty managed to obtained almost R50 million worth of apparatus in 2005.

The strategy was continued in 2006 when an agreement to the value of R7 542 531 was reached with Shimadzu, according to which apparatus was supplied to the faculty at discount prices. The agreement, which is valid for three years, entails the free replacement of apparatus which is purchased during this period with upgraded versions.

The new apparatus forms part of the UFS vision to compete internationally with quality research outputs in certain niche areas, to provide leadership in advanced training to students from the African continent and to establish the university as a leader among South African universities.

Two researchers with a B rating from the National Research Foundation (NRF) were also appointed. Both of these initiatives bore fruit and in 2006 the faculty increased its total research outputs by

about 13%. As an example, the Department of Chemistry's outputs increased by 100%.

The faculty has been bursting at the seams over the past couple of years. Student figures rose from 3 935 undergraduate, postgraduate and occasional students in 2005, to 4 224 in 2006. There is also strong representivity of students from other African countries and in 2005/06 almost 600 students studied at the faculty.

An extended B.Sc. programme has been presented to students since 2005. The programme aims at providing students who do not comply with all the requirements for the B.Sc. programme with the necessary substructure to complete the B.Sc. degree successfully. A preliminary evaluation of the results indicates that the programme is delivering the desired results.

The alignment of the Qwaqwa Campus, which was incorporated into the UFS in January 2003, remains a challenge. Regular discussions are held with staff on the campus in order to make the faculty's programmes more sustainable and to align it with the broader strategic plan of the UFS.

On a national level, the faculty is in the process of making its mark in terms of teaching and community service. In 2005 the faculty again actively began utilising its experimental farms. A three-way agreement between the UFS, the National Farmers Union (NAFU) and the Mangaung Local Municipality led to the establishment of the Lengau Agricultural Development Centre on the Sydenham Experimental Farm. The centre provides training and mentorship to small-scale upcoming farmers.

To be dynamic and progressive requires innovative thinking. It requires commitment and a desire to deliver excellent teaching and learning opportunities to students. It requires a willingness to form partnerships, and a multi-disciplinary and practical approach to the tertiary education environment in South Africa.

This report covers the faculty's activities in 2005/06. It is a reflection of two years' commitment on the part of a team of skilled and motivated academics and support staff.

Prof. Herman van Schalkwyk

Dean: Faculty of Natural and Agricultural Sciences
University of the Free State

Department of

Physics

"The department is internationally recognised."

Prof. Hendrik Swart.

Overview

The Department of Physics strives for quality teaching in Physics, comparable to international standards.

During 2005/06 the department was in the enviable position of having a number of highlights in terms of academic excellence as well as in terms of direct contributions to the benefit of the Faculty of Natural and Agricultural Sciences and the community. The sustainability of the department's initiatives also received a boost as a result of outside funding and the consolidation of overseas research collaboration as well as contact with industry. The incorporation of the Qwaqwa Campus was also furthered by the appointment of new staff.

The department maintains a high rate of research outputs. In 2005, 17 articles in accredited scientific journals were published and more than 25 contributions to national and international congresses were made. In 2006 altogether 22 articles were published in accredited scientific journals and 30 contributions to national and international congresses were made.

Students from the department walked away with several prizes during the 2005/06 annual conference of the South African Institute of Physics (SAIP). During the conference held in 2005 the winners were: Messrs Heinrich Joubert (best publication in Solid State Physics and/or Materials Science resulting from an M.Sc. degree, and best Ph.D. poster in Condensed Matter Physics and Materials Science), Piet Maphoto (best M.Sc. poster in Applied and Industrial Physics), Mr Richard Harris (best M.Sc. poster in Condensed Matter Physics and Materials Science) and Ms Elmé Breedt (best M.Sc. lecture in Astrophysics).

In 2006 the winners were: Messrs Martin Ntwaeaborwa (best Ph.D. lecture), Heinrich Joubert (best Ph.D. publication), Richard Harris (best M.Sc. lecture), Brian van Soelen, (best M.Sc. poster in Astrophysics) and Ms Lisa Coetsee (best M.Sc. poster).

Proff. Hendrik Swart, Departmental Chairperson, and Koos Terblans were respectively elected as vice-chairperson and secretary of the

"The department is internationally recognised for its expertise in phosphor luminescence and accretion-driven outbursts in the universe."

Condensed Matter Physics and Material Science Specialist Group of SAIP.

The International Union of Pure and Applied Physics (IUPAP) declared 2005 as the World Year of Physics. In recognition of this declaration, the great contribution of Physics to the development of technology and its importance in our everyday lives featured strongly during the National Science Week in 2005.

The project for this part of the country reached thousands of learners and members of the public through exhibitions, public lectures, radio interviews, and educational programmes at the National Museum, in Bloemfontein the Research Institute of Education Planning (RIEP) at the UFS and the Boyden Observatory. A special exhibit on the work and life of Albert Einstein featured during the university's open days and was followed by a science awareness day at the Boyden Observatory in collaboration with the Amateur Astronomy Society of Bloemfontein. "Albert Einstein" also visited the Main Campus in Bloemfontein and presented several shows on the life of Einstein.

Fundamental contributions were made in research, one of which was in the field of phosphor-luminescence. In 2006 the department became involved in a collaboration agreement with the Council for Scientific and Industrial Research (CSIR) to provide a solution for the illumination of streets and roads in townships. The project is based on the use of sunlight to activate nanomaterial in for example cement and paint. At night the cement or paint radiates the light. Nano phosphors are luminescent powders that consist of particles a millionth of a millimeter in size. These particles provide light as soon as they are illuminated by for instance sunlight. The amount of time that light can be provided by these particles is determined by the impurities in the material. This research is being done in co-operation with the University of Zululand. The project has also received extensive coverage in the media.

An amount of R3,9 million was made available by the Council for Scientific and Industrial Research in 2006 for the further development of a project in which sunlight can activate nano material during the day in materials such as cement and paint. At night the cement or paint can radiate light in public areas or private homes. Here is Prof. Hendrik Swart, Departmental Chairperson, with a piece of nano phosphor. **Photo: Volksblad**

Active participation in an international planet search project at the Boyden Observatory was rewarded by the detection

of the first "earth-like" exoplanet. This detection also received good coverage in the media and resulted in a publication in the highly acclaimed scientific journal *Nature*.

Another highlight was that Mr Martin Ntwaeaborwa obtained a Ph.D. in Physics in 2006. He showed that energy is transferred in oxide-based micro scale and nanoscale phosphors doped with rare-earth elements.

Proff. Swart, Terblans and Dr Ntwaeaborwa attended the 53rd International Symposium of the American Vacuum Society (AVS) in San Francisco, United States of America (USA) in November 2006. Proff. Swart and Wiets Roos also attended the *Asian Pacific Conference on Surface Science and Engineering* in Hong Kong in December 2006. After a long period of absence from the annual conference of the Microscopy Society of Southern Africa, Dr Ted Kroon and Mr Shaun Cronjé attended the 45th conference in Port Elizabeth. Dr Matie Hoffman attended the *Theoretical and Experimental Foundations of Recent Quantum Technologies Conference* in Durban.

Research in the department is done by two groups, namely the Solid State and the Astrophysics groups:

Solid State Research Group

Teamwork has been the strong driving force for the research done by this group, led by Prof. Swart, a B-rated National Research Foundation (NRF) researcher.

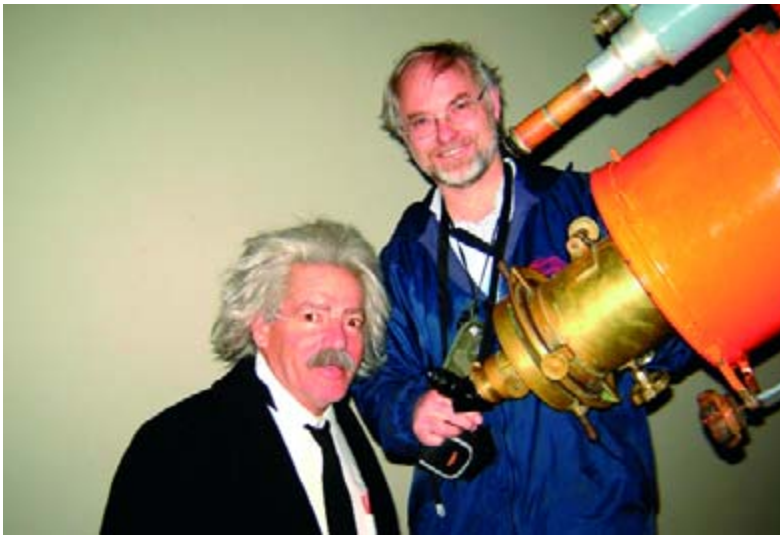
Although the main objective of solid state research is fundamental in nature, the present collaboration with industries such as the National Metrological Laboratory (NML), CSIR, MINTEK, the Armaments Corporation of South Africa (ARMSCOR), Delta batteries and Mittal Steel SA (formerly known as Iscor), in 2005/06 is substantial.

Other developments during 2005/06 included:

- Group members employed surface-sensitive techniques to solve problems in the fields of corrosion of steel and degradation of phosphors used in field emission displays. The phosphor research was expanded to include luminescent nanoparticles.
- Research capabilities of staff members as well as the development of quality postgraduate students were also improved. The main goal of the research, to deliver well-trained students, was achieved throughout.
- The department continued upgrading its apparatus and equipment. New units were developed to be internationally competitive in the field of segregation studies, both in theoretical modelling as well as in experimentally modelling. The accurate control of sample temperature during Auger electron spectroscopy measurements was obtained using a pulsed heater current. In 2005 a new Atomic Force Microscope and a Fluorescence Spectrophotometer were bought with money obtained by the faculty for new research equipment. An X-ray photo electron spectroscope was donated by the NML to the group. Two of the surface characterisation laboratories were named after Proff. Pieter Viljoen and Gerrit van Wyk, former heads of the department and great leaders of the solid state group.
- Characterisation of the microstructure and extended defects of shaped charge liners was started in 2005. The new spectrophotometer will be used to study the degradation of phosphors in industrial applications. A new initiative from Mr Ntwaeaborwa in which nano phosphors are grown locally, was successfully incorporated in the same year. The group proved again, experimentally, that the internationally well-accepted electron-stimulated surface reaction model by Swart and Holloway is also valid for the degradation of other phosphor materials.

Students from the department won five prizes during the 51st annual conference of the South African Institute of Physics, presented in 2006 at the University of the Western Cape. The award winners were, from the left, back: Messrs Martin Ntwaeaborwa, best Ph.D. lecture, Heinrich Joubert, best Ph.D. publication, Ms Lisa Coetsee, best M.Sc. poster, Messrs Richard Harris best M.Sc. lecture, and Brian van Soelen, best M. Sc. poster in Astrophysics; front: study leaders Proff. Pieter Meintjes, Koos Terblans and Hendrik Swart, Departmental Chairperson. Proff. Swart and Terblans were also elected as vice-chairperson and secretary of the Condensed Matter Physics and Material Science of the institute.

In 2005 the UFS became the first university in South Africa to award a masters degree in Physics to students who have completed the National Astrophysics and Space Science Programme. Here are, from the left: Prof. Peter Dunsby, University of Cape Town, Ms Elmé Breedt, student from Pretoria, Mr Edward Jurua, student from Uganda, and Prof. Pieter Meintjes, leader of the Astrophysics Research Group at the department.



During "Albert Einstein's" visit to the UFS, Dr Matie Hoffman, Senior Lecturer at the Department of Physics, showed him the Boyden Observatory.

In 2005 Mr Martin Ntwaeaborwa and Prof. Terblans joined the group of Prof. Paul Holloway at University of Florida, USA for their sabbatical leave. Mr Ntwaeaborwa also visited the University of Pennsylvania, USA for three months at the end of that year. A total of eight M.Sc. and eight Ph.D. students were involved in the research effort.

In addition, the group also helped Delta EMD to slow down severe localised wear in a calciner retort at the company's Black Rock plant. Millions of rands will be saved through this effort.

The international scientific community is starting to acknowledge the group for its work on segregation and degradation models. This is proven by the large number of citations the group has received over the past couple of years.

Astrophysics Research Group

The group focused mainly on magneto hydro dynamic instabilities and turbulence in accretion-driven systems.

The group is led by Prof. Pieter Meintjes, C2-rated NRF researcher, and supported by Dr Hoffman, who leads the scientific educational outreach programme of the Boyden Observatory.

To complement these studies, the UFS astrophysics research group participated in high profile international planet search and gamma-ray burst follow-up programmes in 2005/06. The Boyden 1,5 m telescope played an integral role in these programmes.

For the astrophysics research group, 2005 was a year of several highlights. From a very small beginning a few years ago, the astrophysics research and educational programme has grown to where it plays a fundamental role in the graduate, educational and research programmes of the department. In 2005 three new honours students enrolled, while three M.Sc. students (Messrs Edward Jurua and Hannes Calitz and Ms Elmé Breedt) graduated in the astrophysics programme.

The growing reputation of the UFS astrophysics group has resulted in two of the three M.Sc. graduates joining the group from the National Astrophysics and Space Science Programme (NASSP), hosted by the University of Cape Town (UCT) in 2005. Prof. Meintjes was also a guest lecturer of the NASSP programme in the field of astrophysical fluid dynamics. He presented two research colloquiums, one at UCT and another at the University of the Western Cape. During 2005 one new Ph.D. student,

Standing at the Watcher robotic telescope are, from the left: Mr Victor Litera, electronic technician from the University College of Dublin in Ireland, and Dr Matie Hoffman, Senior Lecturer from the department.

"In terms of research the astrophysics group participated in an observation campaign resulting in the first planet detected with the micro lens technique in 2005."

Mr Francois Squirra from the North-West University (Potchefstroom Campus), joined the astrophysics group. In 2006, three Ph.D. and four M.Sc. students continued their graduate studies in the astrophysics programme under Prof. Meintjes's supervision.

In terms of research the astrophysics group participated in an observation campaign resulting in the first planet detected with the micro lens technique in 2005. This detection resulted in a *Nature* publication with three UFS researchers among the list of international authors. To complement this, three other research publications appeared, one in the proceedings of an international conference and two in high profile international journals.

The fundamental role of the UFS-Boyden astrophysics programme and the strategic positioning of the observatory for the department's international campaigns, resulted in the group receiving a R150 000 grant from the UFS in 2005 to purchase a brand new Apogee back-illuminated CCD camera (R120 000 + import) for participation in these international campaigns.

This is an extremely valuable addition to the research infrastructure of the UFS astrophysics programme. The camera has a quantum efficiency of 80% in the wave-band between the red and blue, which will result in a significant improvement in the data quality, as well as enabling the detection of much fainter stars than currently achievable. This will significantly strengthen the position of the group in the international arena.

The growing research activity of the astrophysics research programme also resulted in the programme receiving healthy NRF funding amounting to R540 000 for the period 2005-2008. An additional R120 000 per year for the past few years was also received from the programme's USA collaborators aimed at funding an observer for joint international observation campaigns.

The strategic positioning of the UFS-Boyden site also resulted in the University College of Dublin in Ireland renting one of the buildings since 2005 to host a very sophisticated 16-inch research class telescope. The telescope will be used mainly for gamma-ray burst follow-up observations (gamma-ray bursts are cataclysmic explosions in space releasing enormous amounts of energy through the emission of high energy photons, namely gamma-rays) and the search for exoplanets (planets associated with stars outside the Solar system). This resulted in an additional income of approximately R74 000 per year used for the upgrading of the site, as well as for funding the internet link to the UFS Main Campus.

Five master's degrees in Physics were awarded in 2006. This is the biggest group of master's degrees in the history of the department awarded during a graduation ceremony. From the left, are: Mr Richard Harris, Ms Puleng Ramoshebi, Prof. Hendrik Swart, Departmental Chairperson, Ms Lisa Coetsee and Mr Etienne Wurth. One of the students, Mr Gerhard Olivier, was absent when the photo was taken.

Academic staff

Main Campus

Professor: Prof. Hendrik Swart
Associate Professor: Proff. Koos Terblans, Pieter Meintjes, Wiets Roos
Senior Lecturers: Drs Matie Hoffman, Ted Kroon
Lecturers: Mr Martin Ntwaeaborwa

Qwaqwa Campus

Senior Lecturers: Dr Francis Dejene
Lecturers: Messrs Piet Mapotho, Justice Msomi, Jappie Dolo, Moses Mothudi, Richard Ocaya

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Research outputs

Publications

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Statistical data of the faculty

Student figures

Faculty of Natural and Agricultural Sciences, 2005/06

Male

2005

Description	African	Coloured	Indian	White	Total
Undergraduate	676	31	26	724	**1457**
Postgraduate	351	22	15	400	**788**
Occasional	84	3	4	17	**108**
Total 2005	**1111**	**56**	**45**	**1141**	**2353**

2006

Description	African	Coloured	Indian	White	Total
Undergraduate	729	28	21	768	**1546**
Postgraduate	385	21	16	431	**853**
Occasional	68	2	2	23	**95**
Total 2006	**1182**	**51**	**39**	**1222**	**2494**

Female

2005

Description	African	Coloured	Indian	White	Total
Undergraduate	563	41	11	394	**1009**
Postgraduate	206	16	11	221	**454**
Occasional	101	5	2	11	**119**
Total 2005	**870**	**62**	**24**	**626**	**1582**

2006

Description	African	Coloured	Indian	White	Total
Undergraduate	641	39	17	401	**1098**
Postgraduate	243	15	17	234	**509**
Occasional	103	2	2	16	**123**
Total 2006	**987**	**56**	**36**	**651**	**1730**

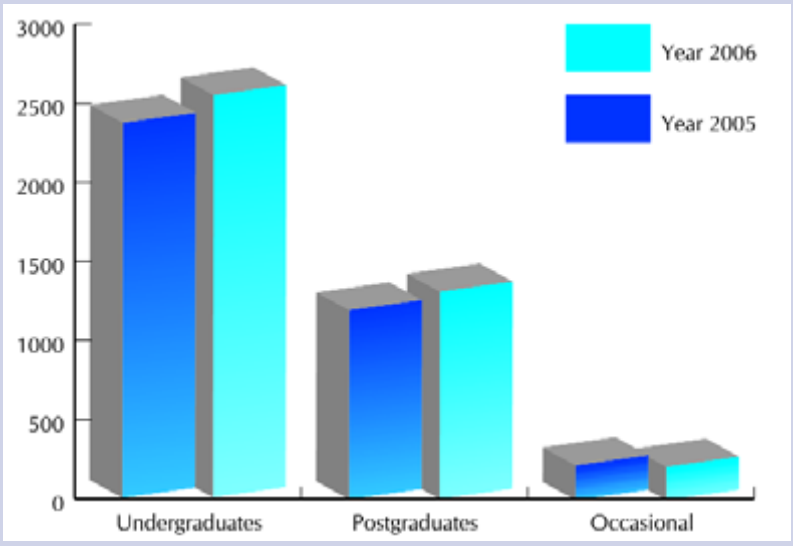
Total

2005

Description	African	Coloured	Indian	White	Total
Undergraduate	1239	72	37	1118	**2466**
Postgraduate	557	38	26	621	**1242**
Occasional	185	8	6	28	**227**
Total 2005	**1981**	**118**	**69**	**1767**	**3935**

2006

Description	African	Coloured	Indian	White	Total
Undergraduate	1370	67	38	1169	**2644**
Postgraduate	628	36	33	665	**1362**
Occasional	171	4	4	39	**218**
Total 2005	**2169**	**107**	**75**	**1873**	**4224**



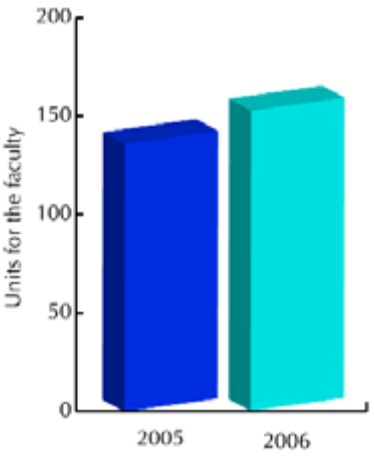
Student figures

Student nationallity

Nationality	2005	2006
Angola	1	
Asian countries	21	18
Botswana	20	20
European countries	6	6
Lesotho	142	142
Malawi	2	1
Mauritius		2
Mozambique	8	7
Namibia	40	42
No information	1	
North America	4	4
Other Africa	45	48
South Africa	3610	3893
South America		1
Swaziland	13	13
Zambia	4	6
Zimbabwe	18	21
Total	**3935**	**4224**

Research outputs

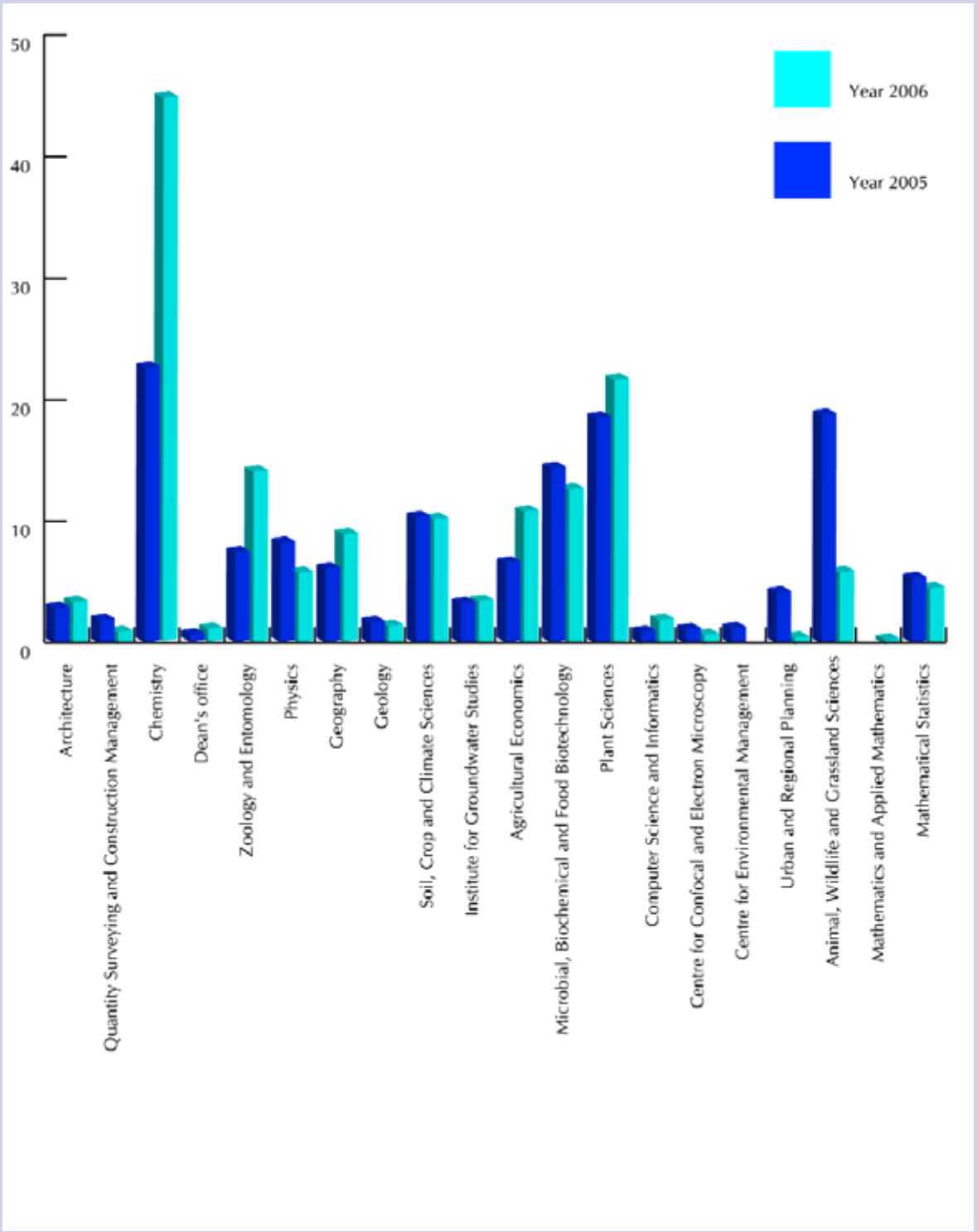
for the Faculty of Natural and Agricultural Sciences



Articles published in accredited approved research journals.

Departmental research outputs

Articles published in accredited approved research journals, 2005/06



Glossary

Glossary

A

ACIAR	Australian Centre for International Agricultural Research
AEASA	Agricultural Economics Association of South Africa
ALPRU	African Large Predator Research Unit
ARC	Agricultural Research Council
ARMSCOR	Armaments Corporation of South Africa
ARS	Agri Risk Specialists
ASAQS	Association of South African Quantity Surveyors
ASSA	Anatomical Society of South Africa
ASTER	Advanced Spaceborne Thermal Emission and Reflection Radiometer
AVS	American Vacuum Society

C

CANSA	Cancer Association of South Africa
CATSA	Catalysis Society of South Africa
CBD	Convention of Biological Diversity
CCEM	Centre for Confocal and Electron Microscopy
CePHMa	Centre for Plant Health Management
CfPB	Centre for People and Buildings
CIAT	International Centre for Tropical Agriculture
CIDB	Construction Industry Development Board
CIMMYT	International Maize and Wheat Improvement Centre
CIOB	Chartered Institute of Building
CIOB-SA	Chartered Institute of Building - South Africa
CSACEE	Central South African Council on Economic Education
CSIC-INTA	Centro de Astrobiología
CSIR	Council for Scientific and Industrial Research
CSIRO	Commonwealth Scientific and Industrial Research Organisation

D

DEAT	Department of Environmental Affairs and Tourism
DiMTEC	Disaster Management Training and Education Centre for Africa
DMISA	Disaster Management Institute of South Africa
DST	Department of Science and Technology

E

EAAP	European Association for Animal Production
EASA	Education Association of South Africa
ECA	European Crystallographic Association
EIGG	Environmental Inorganic Geochemistry Group
EPWP	Expanded Public Works Programme
ESBES	European Symposium on Biochemical Engineering Science
ESREL	European Safety and Reliability
ESRP	Economic and Social Rehabilitation Programme

F

FAO	Food and Agriculture Organisation
FEMS	Federation of European Microbiological Societies
FMP	Facilities Management Programme
FOTIM	Foundation of Tertiary Institutions of the Northern Metropolis
FSRPO	Free State Red Meat Producers Organisation

G

GIS	Geographical Information Systems
Glen ADI	Glen Agricultural Development Institute
GM	Genetically Modified
GMBA	Gauteng Master Builders' Association
GMO	Genetically Modified Organisms
GWK	Griekwaland-Wes Koöperasie

H

HIV	Human Immunodeficiency Virus
HPCSA	Health Professions Council of South Africa
HPLC	High Performance Liquid Chromatography
HSPCM	Health and Safety Programme for Construction Managers

I

IAGOD	International Association on the Genesis of Ore Deposits
IAH	International Association of Hydrogeologists
ICCC	International Conference on Coordination Chemistry
ICEC	International Cost Engineering Council
ICID	International Commission on Irrigation and Drainage
ICP	Inductively Coupled Plasma
ICRBM	International Conference on Rodent Biology and Management
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
IDC	Industrial Development Corporation
IGS	Institute for Groundwater Studies
IITA	International Institute of Tropical Agriculture
INCRoP	Insects on New Crops Programme
INTSORMIL	International Sorghum and Millet Research Support Programme
IPMA	International Project Management Association
IPMP	Intensive Project Management Programme
IRDP	Institutional Research and Development Programme
IRWH	In-field Rainwater Harvesting
IUCr	International Union of Crystallography
IUMS	International Union of Microbial Societies
IUPAP	International Union of Pure and Applied Physics

J

JFM	Journal of Facilities Management

L

LExEn	Life in Extreme Environments

M

MIRCHEN	Microbiological Resources Centre
MIT	Massachusetts Institute of Technology
MRM	Mineral Resource Management
MSA	Master's Degree in Sustainable Agriculture
MSSA	Microscopy Society of Southern Africa
MUCPP	Mangaung University Community Partnership Programme
MURP	Master's Degree in Urban and Regional Planning

N

NaCOF	National Climate Outlook Forum
NAFU	National African Farmers Union
NAMC	National Agricultural Marketing Council
NASA	National Aeronautics and Space Administration
NASSP	National Astrophysics and Space Science Programme
NCEE	National Council for Economic Education
NDA	National Department of Agriculture
NECSA	National Energy Commission of South Africa
NELSAM	Natural Earthquake Laboratory in South African Mines
NERPO	National Emergent Red Meat Producers' Organisation
NGO	Non-Governmental Oganisation
NML	National Metrological Laboratory
NMMU	Nelson Mandela Metropolitan University
NMR	Nuclear Magnetic Resonance
NRF	National Research Foundation
NUFU	Norwegian Council of Universities Committee for Development, Research and Education
NWGA	National Wool Growers' Association

O

OABS	Optimal Agricultural Business Solutions
OECD	Organisation for Economic Co-operation and Development

P

PARSA	Parasitological Association of Southern Africa
PDMIW	Processing and Disposal of Mineral Industry Wastes
POT	Peaks over Threshold
PPP	Public Private Partnership
PRT	Protein Research Trust

R

RICS	Royal Institute of Chartered Surveyors
RIEP	Research Institute of Education Planning
RNA	Research Niche Area
RPO	Red Meat Producers' Organisation

S

SA	South Africa
SAACE	South African Association of Consulting Engineers
SAB	The South African Breweries Limited
SACI	South African Chemical Institute
SACPCMP	South African Council for the Project and Construction Management Profession
SACPVP	South African Council for the Property Valuation Profession
SACQSP	South African Council for the Quantity Surveying Profession
SADC	Southern African Development Community
SAFMA	South African Facilities Management Association
SAFOI	South African Fryer Oil Initiative
SAIP	South African Institute of Physics
SAISC	Southern African Institute of Steel Construction
SAMSI	Statistical and Applied Mathematical Sciences Institute

SANCIAHS	South African National Committee for the International Association of Hydrological Sciences
SANCU	South African National Consumer Union
SANPAD	South Africa-Netherlands Research Programme on Alternatives in Development
SAPOA	South African Property Owners' Association
SAPS	South African Police Services
SAQA	South African Qualifications Authority
SASAS	South African Society for Animal Science
SASQUA	Southern African Society for Quaternary Research
SAVAH	South African Association of Visual Arts Historians
SBE	Sustainable Built Environments
SEDA	Small Enterprise Development Agency
SMME	Small, Medium and Micro Enterprises
SRC	Student Representative Council
SRL	Sustainable Rural Livelihood
SSAG	Society of South African Geographers

T

THRIP	South African National Research Foundation Thrust for Industry-Related Projects
TUE	Technical University Eindhoven

U

UCT	University of Cape Town
UFS	University of the Free State
UJ	University of Johannesburg
UK	United Kingdom
UN	United Nations
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organisation
USA	United States of America
USAID	United States Agency for International Development
UTCHEM	University of Texas Chemical Compositional Simulator
UWC	University of the Western Cape

W

WARFSA	Water Research Fund of Southern Africa
WATOC	World Association of Theoretically Orientated Chemists
WFP	World Food Programme
WITS	University of the Witwatersrand
WRC	Water Research Commission
WUA	Water Users' Association