



# Developing graduates who will change the world

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When questioned about his vision of a typical graduate from the Faculty of Engineering, the Built Environment and Information Technology at the University of Pretoria, Prof Roelf Sandenbergh, Dean of the Faculty, explains that the Faculty strives to develop people with the ability to change the world.

This is very much in line with the University's academic plan and its strategic plan for 2025, which makes provision for teaching excellence as a foundation for research excellence. In this regard, many of the University's strategic decisions and choices regarding academic planning are framed by the consideration of the University's responsibility to develop the high-level skills that are needed for the economy and South African society, as well as a focus on the University's existing areas of strength and international recognition that will complement its research focus.

According to Prof Sandenbergh, it is the objective of staff members in each of the Faculty's 14 departments – spread across four schools – to optimally develop the talent of their students. "It is our foremost task as educators to empower our students to shape the future. In addition to developing the best engineers, architects and computer scientists in the world, we need to ensure that our students are resilient – multifaceted and able to operate 'out there', in industry and society," he said.

"One of the most effective ways of doing this," said Prof Sandenbergh, "is to ensure that the best systems are in place to provide students with the necessary support." This does not only apply to the Faculty's academic structures, but to research and community service as well. "Our research must be focused on the future, and it must be sustainable, with the ultimate goal of changing the world."

"Our teaching concentrates on providing a depth of knowledge that is well rounded and all-encompassing. By integrating new perspectives into existing knowledge, our students are able to create new knowledge, which will enable them to handle the complexities that they will encounter in the workplace as graduates," he remarked. "The challenge is to inspire our students to be exceptional."

In a nutshell, it is the strategy of the Faculty to provide education of the highest quality and to develop the top researchers in their fields in order to deliver graduates who are recognised as the most knowledgeable and competent in the industry.

## Focused on the developmental needs of the country

The Faculty delivers a large percentage of the country's high-level professionals to ensure a sustainable future. It is a leading source of locally relevant and internationally competitive programmes in engineering, the built environment and information technology at both undergraduate and postgraduate level. It offers a wide spectrum of degree programmes and attracts students and staff of a high quality. The Faculty also offers extended programmes to facilitate inclusiveness. It is well resourced in terms of teaching and research facilities, and houses several research centres and institutes. The Faculty maintains close links with industry, which supports both the teaching and research programmes in its four schools. Its multidisciplinary nature facilitates interaction across disciplines in both teaching and research activities to address national and global challenges. Many of the programmes are nationally and internationally accredited and prepare students for leadership positions in the various professions represented in this Faculty.

The School of Engineering is the largest of its kind in the country in terms of student numbers, graduates and research contributions, and offers programmes and research activities in all the major engineering disciplines: chemical, civil, electrical, electronic and computer, industrial and systems, materials science and metallurgical, mechanical and aeronautical, and mining engineering. Based on citations, it is rated by the Institute for Scientific Information (ISI) as the best school



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of engineering in South Africa. It is also one of only four engineering schools in the country listed in the top 1% of engineering schools in the world. Its research is focused on the developmental needs of the country, and it produces nearly a third of the country's engineering track graduates.

The School for the Built Environment offers programmes in architecture, landscape architecture, interior architecture, town and regional planning, quantity surveying, construction management and real estate, which are accredited both locally and internationally by professional institutions. These programmes cover the entire spectrum of disciplines associated with the built environment, and all have close ties and alignment with the construction industry. Construction projects require the expertise of specialists, and successful physical execution depends on the expertise of those with the appropriate skills and a thorough understanding of the administrative and legal aspects of building developments. Each department in the School is recognised

as one of the leading academic departments of its kind in the country.

The School of Information Technology is unique and the first of its kind in South Africa, where students have the advantage of an integrated approach to information technology (IT), with study programmes and modern laboratories in computer science, informatics and information science.

The Graduate School of Technology Management (GSTM) is the largest school of its kind on the continent and offers formal postgraduate programmes and research activities in the management of technology, engineering management and project management. A strong focus on research ensures relevance to the market in terms of increasing competitiveness, optimising product life cycles, technology transfer and positioning technological abilities within the international context. The school maintains strong links with industry and government and has developed a good local and international research network. A portfolio of continuous

education offerings also ensures that the latest knowledge reaches the broader market.

### **Making an impact through research**

Research is seen as an essential and integral part of the Faculty's activities and is founded on enquiry-based teaching, which leads to research as early as at undergraduate level in the form of group and individual project-based research activities. These develop into more formal courses in research methodology, and basic, as well as applied research at postgraduate level.

The Faculty's researchers concentrate on problems of national and/or regional concern in order to maximise local impact, while enhancing the University's academic stature and visibility in a highly competitive global environment. Its research agenda is aligned with the needs of industry, government and professions with the aim of also making significant contributions internationally.



There is significant support from industry for the Faculty's research activities in the form of sponsorships for research chairs, bursaries for students and funding for expanded facilities like laboratories and research centres.

Research in the Faculty is supported by excellent laboratory and support services, which are further augmented by state-of-the-art teaching and research facilities. Major recent additions to the Faculty's research infrastructure include a geotechnical centrifuge to facilitate research in geotechnical engineering and a wafer prober to make direct evaluation of microchips possible in support of the Faculty's millimetre-Wave spectrum research, with potential application in the Square Kilometre Array (SKA) project.



Departments are encouraged to develop and consolidate research activities and promote the alignment of student research with those of their supervisors, especially in the professional graduate programmes, to increase the quality and impact of research outputs. The quest remains to improve both the participation of staff in research activities and the number and quality of research outputs.

The Faculty's research output is continuing to increase. The number of researchers rated by the National Research Foundation (NRF) is also on the rise.

**NRF ratings for the Faculty in 2011/12**

Rating	Number
A2	1
B1/B2	3
B3	7
C1	12
C2	12
C3	14
Y1	2
Y2	2
<b>Total</b>	<b>53</b>



## Support from industry

The Faculty has a number of industry-sponsored research entities, which make significant contributions to building a research ethos. These include the following:

- The South African Research Chairs Initiative (SARChI) Chair in Fluoro-material Science and Process Integration
- The SARChI Chair in Carbon Technology and Materials
- The SARChI Chair in Artificial Intelligence
- The South African National Energy Development Institute (SANEDI) National Hub for Energy Efficiency and Demand-side Management (EEDSM)
- The Industrial Metals and Minerals Research Institute (IMMRI)
- The South African Institute of Welding (SAIW) Centre for Welding Engineering

The following new industry-sponsored chairs were also established during 2013:

- The Sasol Chair in Health Safety and the Environment
- The Bateman Chair in Minerals Processing
- The Exxaro Chair in Energy Efficiency
- The Chair in Electronic Defence and Radar
- The CBI Electric Low-voltage Chair in Power Electronics

Research in and the development of mobile applications have been strengthened with the establishment of the BlackBerry Apps Laboratory. This forms part of the e-Skills Institute initiative. Other highlights in support of research in the Faculty include the establishment of the African Centre of Excellence for Information Ethics, with the support of the Department of Communications, to further education and research in this field on the African continent. The Eskom Specialist Centre in Plant Asset Management was established in the Department of Mechanical and Aeronautical Engineering as part of the Eskom Power Plant Engineering Institute.

The Faculty also hosts the interfaculty Institutional Research Theme (IRT) on Energy, in which an interdisciplinary approach to energy research is promoted and supported. A research focus area on regenerative and sustainable construction has also been established in the School for the Built Environment.

The further development, application and commercialisation of research are priorities for the Faculty. Excellent progress has been made with the further development of silicon-based light-emitting devices, initiated in the Carl and Emily Fuchs Institute for Microelectronics (CEFIM), and further developed through a joint initiative with the South African Intellectual Property (SAIP) Fund as the INSiAVA initiative.

It has the potential to significantly enhance the performance of electronic devices by using silicon-based light sources for data communication and visual displays.

## Increasing the number of engineering graduates

The Faculty is able to contribute to meeting the national need for more engineers. This has been made possible by the support and investment of government and the University in the future growth of the Faculty. The recently completed teaching and research facilities in the Engineering 3 Building make it possible for the University to accommodate the envisaged growth of its School of Engineering over the next few years, and also contribute to the delivery of engineers to the market who are innovative thinkers.

The School of Engineering subscribes to a new approach to engineering education that aims to teach students the technical fundamentals of their disciplines, as well as non-technical skills. These skills include working in teams, communicating through written or oral presentations, considering their work in the context of society, as well as professional ethics. Instead of emphasising analysis and problem-solving in a theoretical realm, students participate in team-based projects where they go through the cycle of

conceiving, designing, implementing and operating (CDIO).

The growth in student numbers, especially in students from previously disadvantaged groups, is also in line with the University's growth strategy over the next 15 years, which entails planned growth that is realistic and "smart" in terms of the dual focus on areas that will enhance the output of research, while maintaining existing high-quality professional programmes. The focus of the Faculty is to concentrate on increasing the number of graduates in engineering and postgraduate programmes in order to provide the country with these much-needed high-level skills. The University's strategy in this regard is to shift the future shape of the institution in favour of science, engineering and technology, and high-priority disciplines at undergraduate level. This will facilitate the creation of a strong pipeline for postgraduate selection.

## Maintaining a reputation of excellence

Due to its reputation of providing excellent teaching and research, and producing graduates of such a high calibre, the University has been able to increase the support it receives from industry partners in the form of members of advisory boards, funding for research chairs, centres and laboratories, bursaries for students and the placement of graduates.

The Faculty's researchers make a unique contribution to their individual professions, which not only address current challenges, but focus on the future sustainability of both man and machine.

By optimising the use of its resources, the Faculty is confident that it will continue to recruit the best staff and students, and maintain its position of excellence. In this way, it can contribute to the recognition of the University of Pretoria as Africa's leading research-intensive university, recognised internationally for its quality, relevance and impact, as well as for developing people, creating knowledge and making a difference locally and globally. 🌐