20 22/23

EBIT TRENDS

Innovating our tomorrow

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Faculty of Engineering, Built Environment and Information Technology

Fakulteit Ingenieurswese, Bou-omgewing en Inligtingtegnologie / Lefapha la Boetšenere, Tikologo ya Kago le Theknolotši ya Tshedimošo

Make today matter

MESSAGE FROM THE OFFICE OF THE *DEAN*

The Faculty of Engineering, Built Environment and Information Technology (EBIT) at the University of Pretoria (UP) is home to a generation of leaders and innovators who are dedicated to improving their lives, the lives of their families, their country and the world.

The Faculty attracts high-quality students and staff who actively contribute to their fields of specialisation. Qualified, future-ready professionals in these fields are assets to the economy of a country. They possess highly technical skills and process-thinking abilities, and are problem-solvers. Our graduates have the ability to make an important contribution, not only to their respective industries, but also to widespread social welfare. With its wide range of specialist fields, EBIT develops a unique collection of critical skills through collaboration and a commitment to research excellence. Over the next five years, the Faculty will focus on transdisciplinary research to develop critical mass and synergies at the intersection of its research focus areas. Its slogan, “Innovating our Tomorrow”, keeps it on the path of pursuing innovation. It is committed to remaining relevant and addressing the challenges of the Future of Work.

Prof Wynand JvdM Steyn
Dean: Faculty of Engineering, Built Environment and Information Technology

CONTENT

EBIT IS ONE OF A KIND

The Faculty of Engineering, Built Environment and Information Technology at UP is the only faculty at a higher education institution in South Africa that offers the unique combination of these three fields. This places the Faculty in a position to conduct exceptional multidisciplinary research to address relevant challenges in society.

EBIT is a source of locally relevant and internationally competitive programmes, and home to some of the University's exceptional researchers.

14 SPECIALISED ACADEMIC DEPARTMENTS

100 NATIONAL RESEARCH FOUNDATION (NRF)-RATED RESEARCHERS

72% OF EBIT ACADEMICS HOLD DOCTORAL DEGREES

EBIT
- ENGINEERING
- BUILT ENVIRONMENT
- INFORMATION TECHNOLOGY

EBIT IS ORGANISED INTO FOUR SCHOOLS

SCHOOL OF ENGINEERING

The School of Engineering presents programmes in all the major engineering disciplines, with many specialisations offered at postgraduate level. It is ranked **284TH** out of more than 10 000 engineering schools in the field of engineering and technology.

SCHOOL FOR THE BUILT ENVIRONMENT

The School for the Built Environment offers the entire spectrum of programmes in this field, and prioritises close ties and alignment with the building industry. The School places a particular emphasis on the equitable and sustainable development of people.

SCHOOL OF INFORMATION TECHNOLOGY

The School of Information Technology is a forerunner in the South African IT environment. With its unique integration of the fields of computer science, informatics and information science, researchers benefit from an integrated approach, supported by modern laboratories.

GRADUATE SCHOOL OF TECHNOLOGY MANAGEMENT

The GSTM is the largest school of its kind in Africa, and offers the only Master in Project Management programme in Africa to be accredited by the Global Accreditation Centre for Project Management Education Programs (GAC) of the Project Management Institute, USA.

WE ARE A TOP-RATED FACULTY

The heartbeat of the Faculty is innovation. EBIT researchers are rising to the challenge of ensuring that they can make a significant contribution to society at large by focusing their research on topics that lead to real-world change.

EBIT is one of the few academic faculties in Africa to feature among the top 550 in the world in **FIVE** subject areas in the 2023 QS World University Rankings by Subject in the field of engineering and technology, as well as in the subject area of Architecture and Built Environment, featuring in the top 240 in the world.

WE HAVE WHAT YOU ARE LOOKING FOR

29	44	59	37
undergraduate programmes	honours programmes	master's programmes	doctoral programmes

- CHEMICAL ENGINEERING
- COMPUTER SCIENCE AND INFORMATION SYSTEMS
- ELECTRICAL AND ELECTRONIC ENGINEERING
- MECHANICAL AND AERONAUTICAL ENGINEERING
- MINERAL AND MINING ENGINEERING
- ARCHITECTURE AND BUILT ENVIRONMENT

WHY #ChooseUP

The University of Pretoria was established in 1908. As one of the country's oldest and most prestigious universities, UP produces sought-after graduates, who become well-rounded, socially responsible citizens. EBIT is the largest of the University's nine faculties, and produces some **28%** of South Africa's graduate engineers.

The University strives to instill in its students, graduates and staff a realisation that every action in the present shapes the future, and encourages them to make today matter.

QUALITY

RELEVANCE AND IMPACT

DEVELOPING PEOPLE

CREATING KNOWLEDGE

MAKING A DIFFERENCE

UP's most important asset is its creative capital – an arsenal of thinkers and innovators whose ideas can be used to advance cutting-edge research, make a social impact and be turned into valuable products and services.

Over the years, UP has consistently achieved research outcomes that place it among the top-performing research institutions in South Africa. The University intentionally focuses on research that matters in areas that demonstrate an impact on society. To this end, UP is the only representative from Africa in the new University Social Responsibility Network, an international group of **16** top universities.

INTERNATIONAL COLLABORATION

Collaboration in Africa is particularly important to UP, and several institutes, centres and units support research that reaches into the continent. In support of this strategy, UP maintains a strong international profile among its students, staff , with a high academic output.

FACILITIES

EBIT boasts over **90** laboratories across three of the University's campuses. This includes the state-of-the-art **Engineering 4.0 Complex**.

THE FUTURE IS HERE...

Technology has launched a digital transformation process that extends beyond tools and processes. It impacts on individuals and organisations, resulting in the improved wellbeing of both people and the planet. It also enhances globalisation by removing physical barriers and making it possible to work anywhere, anytime, on any device. Future-focused and transdisciplinary research is imperative to make sense of this new digitalised world.

ENGINEERING 4.0 COMPLEX

EBIT champions the University's work towards the Sustainable Development Goals (SDGs) of the United Nations, SDG 9: Industry, Innovation and Infrastructure. In this regard, our state-of-the-art Engineering 4.0 Complex is positioning the University of Pretoria as a centre of excellence in smart transportation. It is the result of a partnership with the South African National Roads Agency Limited (SANRAL), the Council for Scientific and Industrial Research (CSIR) and York Timbers.

Engineering 4.0 shares its vast resources in technology and data science with all the University's faculties via Future Africa, which is a platform for developing interdisciplinary and transdisciplinary research networks within the University and the global research community.

HOME OF THE SMART ALTERNATIVE TRANSPORT PLATFORM

The research done at the Engineering 4.0 Complex is a testimony to EBIT's thought leadership and frontline position on the global stage. The Faculty's smart alternative transport platform puts future-focused development on centre stage. One of its newest innovations is SmWoef.

SmWoef can transport sensors into high-risk environments that are not safe or accessible for humans, in order to collect useful data. This is an excellent example of how robots and humans can co-exist and work together to innovate our tomorrow.

Researchers in the Faculty's Department of Civil Engineering are currently training SmWoef to assist with multiple research projects at Engineering 4.0.

The **Engineering 4.0 Complex** houses several laboratories, and research and training facilities, including a concrete laboratory, a timber laboratory and a training laboratory. It is also the site of SANRAL's National Roads Materials Reference Laboratory, where the independent reference testing of materials for the road construction industry will take place, as well as an accelerated pavement testing track, which entails a dedicated lane on the N4 into Pretoria that can be monitored to study data related to traffic, pavement design and road construction. This will support cost-effective and innovative pavement engineering for Africa's infrastructure development.

Through this initiative, the Faculty is well on its way to earning itself the reputation as the country's leading expert in smart transportation. Through its focus on the development of an integrated transportation system, its research is also concentrating on the reduction of energy consumption levels in transportation, maximising productivity in industry and creating a higher quality of life for the country's citizens.

FLAGSHIP TRANSDISCIPLINARY RESEARCH PROJECTS

THE HATFIELD DIGITAL TWIN CITY INITIATIVE

The Hatfield Digital Twin City initiative has real-world application with multiple stakeholders. The Digital Twin environment is a collaborative data-driven platform that allows for a multitude of research and experimentation opportunities to occur.

This project focuses on the 10 km^2 area that forms the Hatfield Metropolitan Development Node. This includes, among others, the University of Pretoria's Hatfield Campus, university-owned residential assets and the Future Africa Campus.

The Hatfield Digital Twin City provides opportunities for transdisciplinary work, and acts as a testbed for the development of smart applications that support improved service delivery, more efficient use of resources and building urban resilience.

For example, for facilities management and the civil infrastructure environment, the focus is on the development of continuous responsive networks, where real-time data informs maintenance and management decisions on both the local and national scale. The success and new possibilities from such collaboration could lead to a longer-term vision to establish a centre of excellence for African digital and smart cities, hosted and anchored in the University of Pretoria.

SMART TRANSPORTATION FOR THE FUTURE

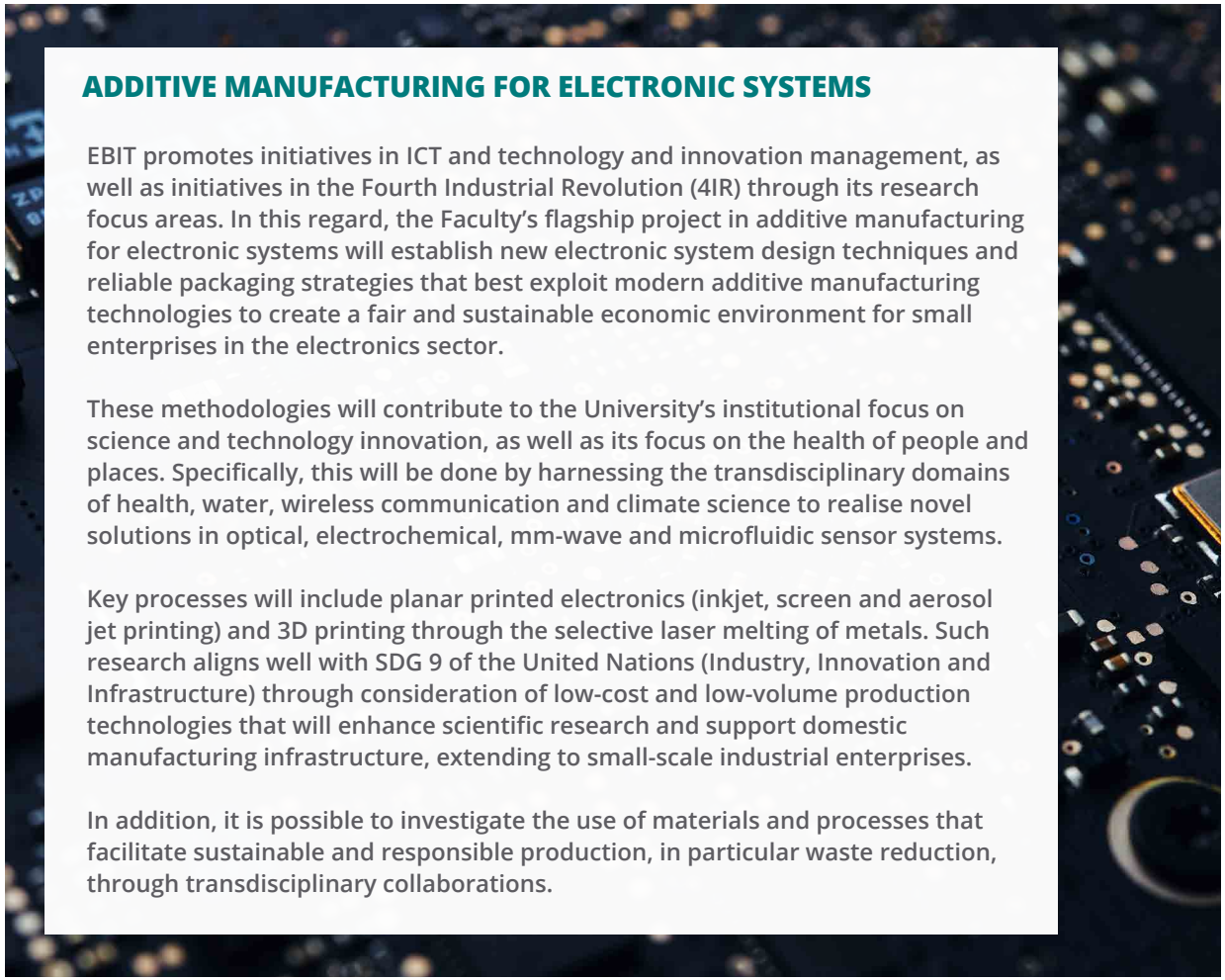
Transportation research at the Engineering 4.0 Complex focuses on real-world problems through a so-called transportation hub. The goal is to directly contribute to the creation of a Connected Africa in the future.

Long-range sensor networks support data collection for a suite of environmental and infrastructure-related parameters, including air quality, temperature and humidity.

The project also supports research into smart alternative transportation issues, such as the use of unmanned aerial vehicles in support of data collection in areas where traditional transportation options are compromised.

This includes a focus on the use of sensors in the agricultural sector to evaluate the interlinks between transportation and agriculture produce quality. Through sensor networks and intelligent transportation, researchers are also able to monitor the health of people, places and animals.

This research focus area specifically integrates with the University of Pretoria's wider research theme for both a Connected Africa and the health of people and places.



ADDITIVE MANUFACTURING FOR ELECTRONIC SYSTEMS

EBIT promotes initiatives in ICT and technology and innovation management, as well as initiatives in the Fourth Industrial Revolution (4IR) through its research focus areas. In this regard, the Faculty's flagship project in additive manufacturing for electronic systems will establish new electronic system design techniques and reliable packaging strategies that best exploit modern additive manufacturing technologies to create a fair and sustainable economic environment for small enterprises in the electronics sector.

These methodologies will contribute to the University's institutional focus on science and technology innovation, as well as its focus on the health of people and places. Specifically, this will be done by harnessing the transdisciplinary domains of health, water, wireless communication and climate science to realise novel solutions in optical, electrochemical, mm-wave and microfluidic sensor systems.

Key processes will include planar printed electronics (inkjet, screen and aerosol jet printing) and 3D printing through the selective laser melting of metals. Such research aligns well with SDG 9 of the United Nations (Industry, Innovation and Infrastructure) through consideration of low-cost and low-volume production technologies that will enhance scientific research and support domestic manufacturing infrastructure, extending to small-scale industrial enterprises.

In addition, it is possible to investigate the use of materials and processes that facilitate sustainable and responsible production, in particular waste reduction, through transdisciplinary collaborations.

RESEARCH FOCUS AREAS

Through the Faculty's research strategy, it encourages research and innovation that is not restricted to only finding solutions to challenges within a particular discipline, but rather to developing initiatives that will have an impact locally, regionally and across the globe. Each research focus area considers key priority areas with the potential to address challenges around the world. The Faculty has been ranked in the **top 1%** in the world in terms of research output by the ISI Essential Science Indicators.

ENABLING TRANSDISCIPLINARY RESEARCH

1 WATER AND ENVIRONMENTAL ENGINEERING

Water quality, wastewater treatment, waste treatment, biotechnology, engineered nanomaterials, sustainable building methods, bio-sensors, environmental, mining and rock engineering, and environmental management and leadership.

2 MINERALS AND MATERIALS BENEFICIATION

Metals and minerals extraction and processing, advanced manufacturing, polymers and advanced alloys fabrication, nuclear accident-resistant fuel cladding, nanofluids, bio-nanofluids, nanocellulose, carbon nanotubes, thermal-fluid behaviour and heat transfer.

3 THE FOURTH INDUSTRIAL REVOLUTION (4IR)

Computer science and engineering, electronic and systems engineering, bioengineering, additive manufacturing, condition monitoring, artificial intelligence (AI), signal processing, optics, power electronics, control systems, micro-electronics, electromagnetism, and road and pavement research.

4 SMART CITIES AND TRANSPORTATION

Spatial transformation, healthy urban systems, regenerative public spaces, building-integrated urban agriculture, modular construction, sustainable built environment, intelligent transportation and infrastructure, railway engineering, vehicle dynamics, autonomous and electric vehicles and intelligent modelling.

5 ENERGY

Load and distributed generation balancing, energy resources storage and utilisation, sustainable energy systems, renewable energy generation and penetration into micro- and traditional grids (hydro, photovoltaic and wind power) and clean energy (solar energy, heat exchange and nanofluids).

6 BIG DATA SCIENCE, ICT AND TECHNOLOGY, AND INNOVATION MANAGEMENT

Machine and statistical learning, cybersecurity, digital forensics, data science, AI, enterprise architectures, condition monitoring, software engineering, technology, innovation and engineering management, supply and value chain optimisation, ICT for development, human-computer interaction.

FIND THE POSTGRADUATE PROGRAMME THAT IS RIGHT FOR YOU | www.up.ac.za/faculty-of-engineering-built-environment-it/programmes/year/2022/type/pg

RESEARCH ENTITIES

INDUSTRY CHAIRS

- Absa Chair in Data Science
- Anglo-American Chair in Pyrometallurgy
- Chair in Nuclear Safety and Security
- DRS Chair in Cybersecurity
- Eskom Chair in Plant Asset Management
- Exxaro Chair in Energy Efficiency
- Exxaro Chair in XR Technology
- Harmony Chair in Rock Engineering and Numerical Modelling
- Rand Water Chair in Business Management
- Rand Water Chair in Electrical Engineering
- Rand Water Chair in Water Utilisation
- SARChI Chair in Artificial Intelligence for Sustainable Development
- Sentech Chair in Broadband Wireless Multimedia Communication
- South African Council of Shopping Centres Chair
- MultiChoice Chair of Machine Learning
- Murray and Roberts Chair in Industry 4.0

CENTRES AND INSTITUTES

- African Centre of Excellence in Information Ethics
- Carl and Emily Fuchs Institute for Micro-electronics
- Centre for Asset Integrity Management
- Centre for Connected Intelligence
- Centre for Electromagnetism
- Centre for New Energy Systems
- Centre for Pyrometallurgy
- Centre for Transport Development
- Industrial Metals and Minerals Research Institute (IMMRI)
- SAIW Centre for Welding Excellence
- Institute for Big Data and Data Science
- Institute for Technological Innovation
- Mining Resilience Research Centre

16 externally funded research chairs

13 research centres and institutes

400+ annual master's and doctoral graduates

RESEARCH SUPPORT

DEPARTMENT OF RESEARCH AND INNOVATION

To support its postgraduate students, UP hosts the Department of Research and Innovation (DRI). The Department fulfills its role by integrating people, resources and opportunities that make it possible for researchers at every stage of their careers to develop and excel.
DRI supports postgraduate students with the following functions:

- Research capacity development and research grants management
- Postgraduate student support hub
- Innovation and contract management
- International cooperation
- Research systems and operations

RESEARCH SUPERVISION

Each department in the Faculty provides research supervision to its postgraduate students from within its own research teams. Students work closely with their assigned supervisors, which promotes excellent research relationships. The staff members assigned to students as supervisors are discipline experts with the ability to provide high-quality research supervision.

FACULTY STUDENT ADVISORS

The Faculty Student Advisors (FSAs) seek to empower students by teaching them life skills through holistic development interventions. To support its postgraduate students, EBIT has appointed a dedicated FSA for honours students.

INNOVATION IS OUR BUSINESS

EBIT ENCOURAGES ITS RESEARCHERS TO WORK ON THE FOREFRONT OF INNOVATION.

DISRUPTIVE TECHNOLOGY

VIRTUAL AND AUGMENTED REALITY

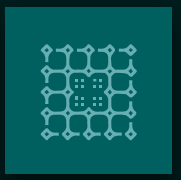
INTERNET OF THINGS

MACHINE LEARNING

ADDITIVE MANUFACTURING

GREEN BUILDING

ARTIFICIAL INTELLIGENCE



SMART GRIDS

DIGITISATION

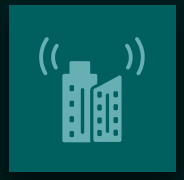
SOCIETY 5.0

BIG DATA

SMART ALTERNATIVE TRANSPORT

ROBOTICS

AUTOMATION



SMART CITIES

ebit generation
noun

1. innovator
2. change-agent
3. technology leader

EBIT STUDENT LIFE

Although the Faculty expects total commitment from its students with regard to individual and group work, it also encourages them to actively participate in university student life. This supports the development of well-rounded future leaders. The University hosts a wide range of student life activities through campus organisations like the Student Representative Council (SRC), Student Culture (STUKU), the Student Sport Committee (SSC) and RAG.

All the Faculty's students automatically become part of **EBIT House**, a student structure that forms part of the SRC sub-structure. EBIT House represents students and acts as a communication channel between the Faculty and its students. EBIT House offers academic, professional and personal development opportunities. Within EBIT House, students can find a variety of discipline-specific subhouses through which to become involved in more specialised student activities.

FOLLOW EBIT HOUSE ON SOCIAL MEDIA

TEACHING AND LEARNING

EBIT has a progressive strategy in place to address several key priorities, including increasing overall module success rates, increasing minimum-time completion rates, transforming the curriculum, bringing about transformation through the curriculum, systematically monitoring the implementation of the hybrid model of teaching and learning, and improving the Faculty's international ranking through teaching and learning practices.

The University of Pretoria's approach to teaching and learning embraces inquiry-based learning, hybrid learning and community-based learning. Key drivers to achieving institutional teaching and learning goals include the centrality of the academic mission and the student-centredness of the University's offerings. EBIT academics have started to implement award-winning projects to accelerate the transformation of teaching.

PRE-UNIVERSITY INITIATIVES

In order to attract young people who share in EBIT's vision of a better and more innovative tomorrow, the Faculty hosts an annual event for school learners with the potential to meaningfully contribute to the EBIT Generation. This is called **EBIT Week**. It is a four-day holiday programme for learners in Grade 10, Grade 11 and Grade 12. During the week, prospective students are given a broad view of the departments in the School of Engineering, the School for the Built Environment and the School of Information Technology. During this hands-on event, learners are introduced to the practical, as well as the theoretical aspects of the study programmes offered by EBIT to help them make sound career choices. As part of the programmes, learners obtain industry exposure, in addition to being introduced to all EBIT's on-campus facilities. In 2020, the Faculty also launched its online **EBIT Open Day** for learners in Grade 8 to Grade 12.

LEARN MORE | www.up.ac.za/ebitweek

TAKING TEACHING AND LEARNING TO THE NEXT LEVEL

The University of Pretoria's commitment to ensuring that its teaching and learning initiatives enable students to excel and graduate in the minimum time set out for a degree, and to continue to pursue postgraduate studies, is entrenched in a culture of excellence. With the assistance of the Department of Higher Education and Training (DHET) in the form of the Scholarship of Teaching and Learning (SoTL) Grant, its academics have the opportunity to conduct research that will enhance their teaching and learning outcomes.

Two such initiatives are a project on instructional methodologies for lifelong learning, led by Dr Tania Prinsloo, and a project on student success in the School of Engineering, led by Dr Helen Inglis.

INSTRUCTIONAL METHODOLOGIES FOR LIFELONG LEARNING

Lifelong learning is a useful and beneficial skill. Students in the University of Pretoria's Faculty of Engineering, Built Environment and Information Technology are taught Sage Pastel in their first year of study, using the Instructional Methodologies Framework for Lifelong Learning. The framework includes problem-based learning, e-learning, reciprocal teaching, professional portfolios, reflections and knowledge maps.

In a research project that examined the instructional methodologies framework applied to the Sage Pastel first-year module, students were asked how they experienced the module. Their responses were mapped to the framework to demonstrate their journey.

The research study concluded that the majority of the students found the approach useful as a lifelong learning skill, with an 85% positivity indicator.

The teaching environment used for this research was unique, as the data was gathered in 2021, when the University was teaching only online because of COVID-19 restrictions. However, the benefits of following a lifelong learning approach were evident.

Future research will include comparing this module to other first-year modules that follow a similar approach to determine if students do, indeed, become lifelong learners.

STUDENT SUCCESS IN THE SCHOOL OF ENGINEERING

Much has been written about student success from the perspective of the Global North. The interventions proposed in these studies may not be practicable or relevant in an African context. In order for engineering education research to contribute to changes in practice, it needs to be relevant to local contexts.

The objective of a larger research project on student success in the School of Engineering, which focused on identifying associated factors and devising interventions, was to expand the current literature on student success to include perspectives from sub-Saharan Africa. An understanding of existing African models for student success in engineering can enable practical interventions in curriculum design and in institutional support structures.

The first phase of this research project explored the perspectives of a small number of experienced engineering educators from a range of countries and institutions in sub-Saharan Africa through an online focus group. This initial unstructured conversation provided an understanding of the current situation in which educators find themselves.

The focus group data allowed the researchers to scope the range of contexts in which student success should be considered in sub-Saharan Africa. It identified critical areas for deeper study and further questioning. Based on this, the researchers were able to develop an interview guide for semi-structured interviews with a wider group of participants. This provided confirmation of the appropriate theoretical framework to be used in the second phase of the project, which entailed analysing the data obtained from interviews.

The findings of this study served as a starting point to develop scholarship around student success from multiple African perspectives, recognising the expertise of African engineering educators, and enriching our understanding of how African engineering institutions engage with this topic.

STUDENT SUPPORT

FOUNDATION PROGRAMMES

EBIT facilitates inclusiveness through the University's Foundation Programmes. These programmes focus on providing educational pathways into science, technology, engineering and mathematics (STEM) fields. Qualifying students complete their first year through the Foundation Programmes before entering a mainstream programme.

ENGINEERING AUGMENTED DEGREE PROGRAMME (ENGAGE)

ENGAGE provides a carefully structured curriculum to help students adjust to university life and cope with the academic demands, and is offered in all engineering disciplines.

EBIT CURRICULUM TRANSFORMATION COMMITTEE (CTC)

The Faculty's transformation efforts are supported by the EBIT-CTC, a structure that assesses teaching and learning in accordance with the UP Curriculum Transformation Framework. The Committee is the custodian of the Faculty Transformation Plan.

FACULTY STUDENT ADVISORS

The EBIT Faculty Student Advisor (FSA) Hub supports students by providing ongoing assistance with study and examination skills, time management and other co-curricular issues. Academic support is rendered at this dedicated facility through an open-door policy. The FSAs seek to empower students by teaching them life skills through holistic development interventions so that they can become well-rounded individuals, employers or employees, and responsible citizens. They also have professional qualifications in counselling, which means that they can identify issues and refer students to the correct support structures.

TUKSNOVATION

TuksNovation is a non-profit company (NPC) for technology incubation and acceleration that is located at the University of Pretoria. It acts as a catalyst for the development of business technology clusters to positively impact on the South African economy. It was established in 2018 in partnership with the Small Enterprise Development Agency (Seda), the Department of Small Business Development and the Department of Trade, Industry and Competition.

INNOVATION COMMERCIALISATION

In a knowledge-driven economy, universities play a major role in regional socio-economic development. Innovations arising from a university's intellectual capital can stimulate economies through new product development. Universities are thus highly valued in terms of economic potential. The creation of spin-offs is one of the key mechanisms that universities can leverage to promote socio-economic development.

SUPPORT FOR STUDENTS

TuksNovation provides technology development and entrepreneurship support, from the prototype to the commercialisation growth stages, to ensure that the technology is fully developed, and addresses a relevant market need. A virtual incubation programme focuses on technology and techno-entrepreneurship skills, while an acceleration programme focuses on commercialisation and business growth.

LEARN MORE | www.tuksnovation.co.za

COMMUNITY ENGAGEMENT

The ability of EBIT students to operate in a complex and multicultural environment is strengthened by the Faculty's focus on community engagement.

COMMUNITY-BASED PROJECT MODULE (JCP)

The JCP module is an essential part of the curriculum of all undergraduate programmes in the Faculty, as it accommodates the need for community service and service-learning projects in a higher education environment. Through this module, students engage with a section of society that is different from their own social background. The goal is for students to develop an awareness of personal, social and cultural values, as well as multidisciplinary and life skills, like communication, interpersonal and leadership skills.

The module requires students to dedicate **40 hours** of their time to a project that they plan and execute, after which they make a YouTube video of the project. JCP students collaborate with the Engineering Without Borders student chapter, the NGO Keep that Gold Shining that was developed by UP students for communties, the Unit for Urban Citizenship, as well as a variety of industry and faculty partners.

23 000+ **students have completed the JCP module since its inception in 2005**

UNIT FOR URBAN CITIZENSHIP (UUC)

The UUC was established in EBIT's Department of Architecture following successful interfaculty collaboration with students from the Foundation Programme on the University's Mamelodi Campus in 2017. It is intended to serve as a platform for embedded participation. The mission of the UUC is to develop the scholarship of civil engagement and participatory development within the context of complex emergent African urbanism. The Unit also seeks to embed a culture of responsible and collaborative urban citizenship in UP graduates and the communities within which they work.

This has become a vehicle through which collaborative community engagement can be developed and researched. Current collaboration with communities and other stakeholders in various neighbourhoods in the City of Tshwane offers a living laboratory for integrated outreach, as well as research and teaching in both undergraduate and postgraduate programmes.

The EBIT Generation

Sign up for the Faculty's alumni newsletter to receive news updates, alumni information and event invitations.

EBIT Times: estie.powell@up.ac.za

Innovating our tomorrow

ALUMNI RELATIONSHIPS

EBIT believes in continuing the relationship that has been formed with its students even after they graduate. The fact that many of its alumni occupy leading positions in industry is testimony to the high value of a qualification from UP, as well as the important contribution its alumni have made to the economic development of the country.

Thousands of alumni have built on the Faculty's firm foundation, giving back to their Alma Mater by reinforcing EBIT's reputation of excellence. Many of the departments in the Faculty recognise the value of their alumni by establishing alumni societies to enable their former students to maintain contact with the University.

Alumni support the Faculty by raising sponsorships and ensuring that high skills and educational standards are maintained. They make their services available as external examiners, and are available for industry discussions and to offer guidance. They are also willing to mentor and support students by means of bursaries and internship opportunities so that newly qualified graduates can make a difference when they enter industry. The Faculty benefits from the expertise of its alumni by inviting them to serve on its Faculty Advisory Board, as well as its various departmental advisory boards. In this way, it has succeeded in establishing a strong partnership with the industries it supports.

EBIT LEADERSHIP

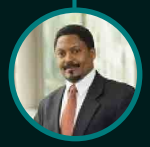
EBIT is led by a group of passionate individuals, each of whom are also acclaimed researchers in their respective fields. The Dean is supported by two deputy deans in the portfolios of teaching and learning, and research and postgraduate studies.

DEAN
PROF WYNAN JVDM STEYN

DEPUTY DEANS

DEPUTY DEAN: TEACHING AND LEARNING
PROF ALTA VAN DER MERWE

DEPUTY DEAN: RESEARCH AND POSTGRADUATE STUDIES
PROF JAMES MAINA



HEADS OF DEPARTMENT: SCHOOL OF ENGINEERING

DEPARTMENT OF CHEMICAL ENGINEERING
PROF MO DARAMOLA

DEPARTMENT OF CIVIL ENGINEERING
PROF H GRÄBE

DEPARTMENT OF ELECTRICAL, ELECTRONIC AND COMPUTER ENGINEERING
PROF RM NAIDOO

DEPARTMENT OF INDUSTRIAL AND SYSTEMS ENGINEERING
PROF O ADETUNJI

DEPARTMENT OF MATERIALS SCIENCE AND METALLURGICAL ENGINEERING
PROF N NAUDÉ

CHAIR: SCHOOL OF ENGINEERING
DEPARTMENT OF MECHANICAL AND AERONAUTICAL ENGINEERING
PROF S KOK

DEPARTMENT OF MINING ENGINEERING
PROF DF MALAN

CHAIR: GSTM
DEPARTMENT OF ENGINEERING AND TECHNOLOGY MANAGEMENT
PROF E VAN DER LINGEN

HEADS OF DEPARTMENT: SCHOOL FOR THE BUILT ENVIRONMENT

CHAIR: SCHOOL FOR THE BUILT ENVIRONMENT
DEPARTMENT OF ARCHITECTURE
PROF C DU PLESSIS

DEPARTMENT OF CONSTRUCTION ECONOMICS
PROF BG ZULCH

DEPARTMENT OF TOWN AND REGIONAL PLANNING
PROF K LANDMAN

HEADS OF DEPARTMENT: SCHOOL OF INFORMATION TECHNOLOGY

DEPARTMENT OF COMPUTER SCIENCE
PROF H VENTER

DEPARTMENT OF INFORMATICS
PROF H SMUTS

DEPARTMENT OF INFORMATION SCIENCE
CHAIR: SCHOOL OF INFORMATION TECHNOLOGY
PROF M HOLMNER

DEPARTMENT OF CHEMICAL ENGINEERING

OUR IMPACT

Chemical engineering contributes to various aspects of human life, ranging from the production of food and energy, to the provision of clean water and sanitation, shelter and health care, and other value-added commodities using chemical, biological and physico-chemical processes. Sadly, unintended by-products of these processes have caused significant damage to human lives and the ecosystem. The training provided in the Department of Chemical Engineering equips our graduates with the required skills that could be directed at eliminating or minimising the negative ecological footprints of unsustainable chemical engineering activities by closing the material cycles and creating value-added commodities from the waste products of these processes using green and sustainable processes. Our researchers work in the following areas:

- Sustainable environment and water utilisation processes
- Sustainable and efficient energy processes
- Advanced and applied materials
- Process synthesis, modelling and optimisation

CAREER OPPORTUNITIES

Qualified chemical engineers can register as professional engineers (Pr. Eng.) after obtaining the required industry exposure. In addition to occupying highly satisfying professional positions, professional engineers can also undertake consultation work. Honours and master's degree programmes in the Department allow postgraduate students to obtain specialised knowledge in their chosen field, which will benefit them in their careers in industry. For those interested in an academic or research career, a PhD degree from the Department is an invaluable asset.

The training provided in the Department is interdisciplinary, aimed at developing and producing graduates with critical thinking abilities to provide solutions to the societal problems confronting South Africa, Africa and the world at large. Our lecturers and researchers have excellent academic credentials, alloyed with a wealth of knowledge and experience to provide sustainable training to our graduates. The Department is equally equipped with state-of-the-art facilities to support our academic and research programmes.

LEARN MORE | www.up.ac.za/chemical-engineering

TOP 300 IN THE WORLD FOR CHEMICAL ENGINEERING
(2023 QS World University Subject Rankings)

WATCH | www.youtube.com/watch?v=IYXw49AZ1Vo

DEPARTMENT OF CIVIL ENGINEERING

OUR IMPACT

The current research of EBIT's Department of Civil Engineering impacts on the delivery of services to the public through the development of optimal road maintenance and water reticulation networks. This, combined with improved geotechnical analysis techniques, construction material improvements and structural analyses, impacts directly on the quality of life of the public. Our researchers work in the following areas:

- Smart cities and transportation
- Transportation development
- Railway engineering
- Railway safety
- Pipelines
- Hydropower
- Geotechnical centrifuge testing and geotechnical engineering
- Concrete materials and structures
- Civil infrastructure materials
- Structural testing
- Urban runoff
- Road pavements and materials

LEARN MORE | www.up.ac.za/civil-engineering

CAREER OPPORTUNITIES

Qualified civil engineers can register as professional engineers (Pr. Eng.) after obtaining the required industry exposure, allowing access to the full scope of civil engineering activities. This may include design, construction, maintenance and management activities.

Honours and master's degree programmes in the Department allow postgraduate students to obtain specialised knowledge in their chosen field, which will benefit them in their careers in industry. A PhD degree from the Department is an invaluable asset for engineers who would like to become specialists in a technical area, or become involved in academia.

SPECIALISATIONS

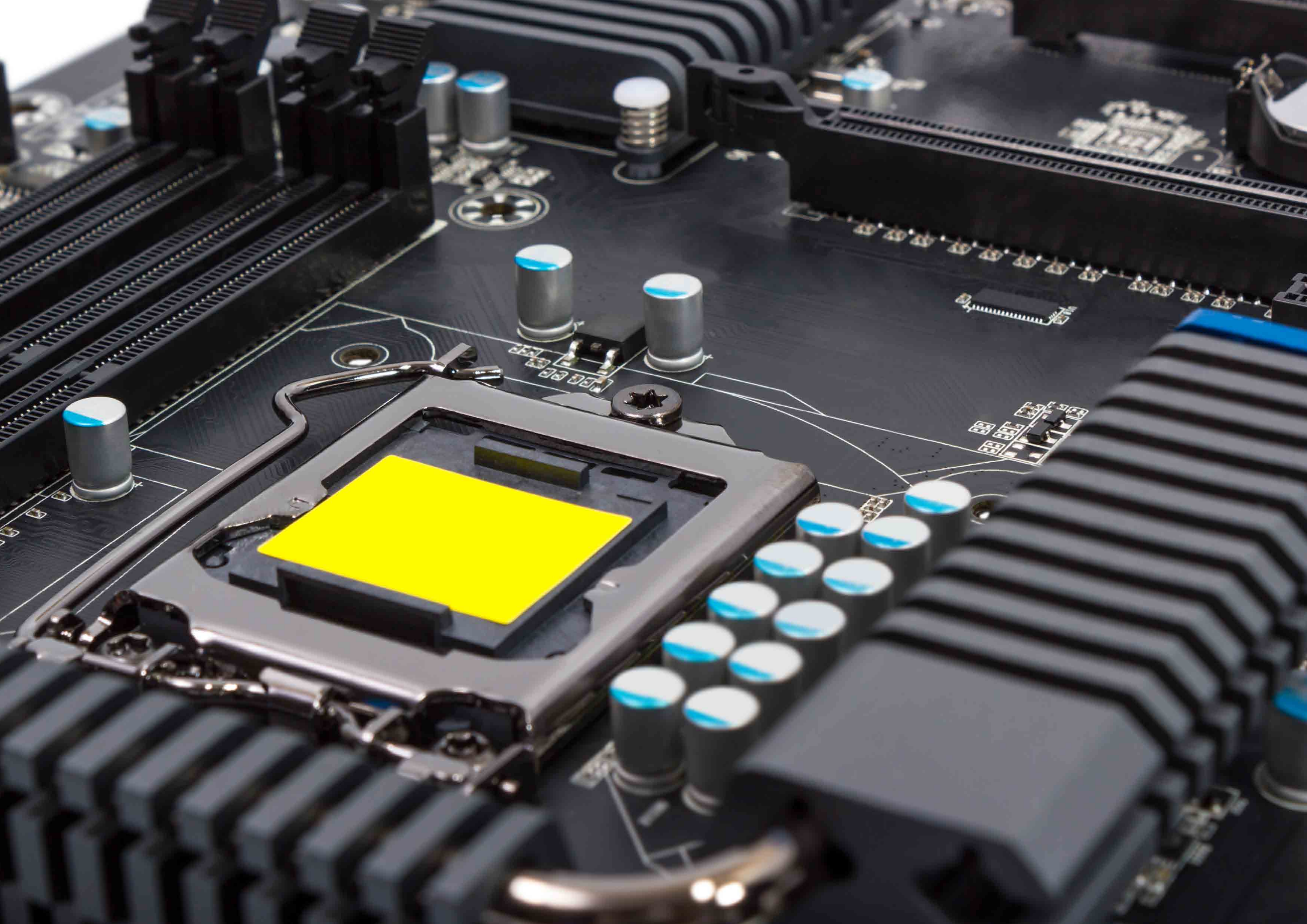
Geotechnical engineering
All engineering aspects of soil and rock fall within the discipline of geotechnical engineering. Current research in the discipline focuses on saturated and unsaturated soil behaviour, soil structure interaction problems, *in situ* testing, and the engineering properties of tailings and other waste. It employs tools such as physical modelling in the geotechnical centrifuge, advanced geotechnical laboratory testing, and numerical and probabilistic analysis.

Structural engineering
A wide spectrum of modules is presented in the discipline of structural engineering, including analytical subjects such as structural analysis and structural mechanics, as well as design courses in reinforced concrete, steel and timber with the support of a concrete materials course. The research in the discipline currently focuses on advanced structural analysis and structural reliability, reinforced concrete, structural steel and structural timber, and the development of construction materials.

Transportation engineering
Most of the research conducted in the discipline of transportation engineering falls under the Centre for Transport Development, a collaborative faculty-wide entity coordinating funding and research within this area. The research in the discipline currently focuses on pavement, transportation planning and traffic, as well as railway engineering.

Water resources engineering
In the discipline of water resources engineering, civil engineers contribute to the sustainable development of a safe water supply to all consumers and the protection of this natural resource through an understanding of the natural hydrological cycle, physical principles and the effect of human interference in the design of pipelines, pump stations, open channels and hydraulic structures, as well as the assessment of the yield from surface water resources.

WATCH | www.youtube.com/watch?v=V0YFU0ziEJg



DEPARTMENT OF ELECTRICAL, ELECTRONIC AND COMPUTER ENGINEERING

OUR IMPACT

The Department produces world-class engineers in electrical, electronic and computer engineering. Many of its graduates are leaders in engineering and also top inventors and entrepreneurs in the world, and many of its lecturers are world-class researchers. Close contact with industry, government and other institutions through contract research and consultation activities adds value to a postgraduate degree in any of our three disciplines. Our researchers work in the following areas:

- Advanced sensor networks
- Bioengineering
- Control systems
- Electromagnetism
- Electronics and microelectronics
- Energy systems
- Intelligent systems
- Power systems
- Telecommunications and signal processing

CAREER OPPORTUNITIES

Electrical engineering focuses on the generation, distribution, conversion and efficient utilisation of electrical energy. Traditional generation stations include coal-fired, hydro and nuclear power stations. There is increased penetration of renewable energy generation such as wind or photovoltaic power into traditional grids. Communication and data collection technologies are integrated to provide more information on the state of the grid and improve its efficiency. These elements apply to electrical grids at various levels of scale, including the industrial, commercial, residential and micro-grid scale.

Electronic engineering is a very broad field and encompasses all kinds of electronic systems. Subfields include microelectronics, signal processing, power electronics, bioengineering, control systems, optics and electromagnetism. Electronic engineering manifests itself in telecommunications (television, radio, cellular communications and optical communication), manufacturing plants (control systems and power electronics), military systems, transport systems and bio-medical applications.

Computer engineering has its focus in both hardware and software. Computer engineers specialise in combining hardware and software to produce optimal solutions to real-world problems. Computer engineering involves the following disciplines: software engineering, the internet, biometric security systems, wireless communication, telecommunications, computer networks, data security, data storage, electronic banking, electronic commerce, signal processing, image processing, embedded systems and designing artificial intelligence algorithms for various applications.

The Department's accreditation from the Engineering Council of South Africa enables graduates to register as candidate engineers, and to apply for registration as professional engineers after obtaining the required industry exposure. For those wishing to engage in research activities related to electrical, electronic and computer engineering, the Department hosts a rich offering in terms of postgraduate qualifications, and a nurturing and vibrant environment for conducting such studies.

#1

IN SOUTH AFRICA FOR ELECTRICAL AND ELECTRONIC ENGINEERING (FOUR YEARS IN A ROW)
(2023 QS World University Subject Rankings)

"We equip our students to build a smarter Africa and world."

LEARN MORE | www.up.ac.za/eece

WATCH | www.youtube.com/watch?v=hOkcMmtVDas

DEPARTMENT OF INDUSTRIAL AND SYSTEMS ENGINEERING

OUR IMPACT

EBIT's Department of Industrial and Systems Engineering works towards the integration of contributions from all engineering disciplines into a functional and cost-effective product by using systems knowledge and understanding. It focuses on supply chain management, and enterprise engineering and optimisation, and collaborates with the Centre for Transport Development.

Industrial engineering is an extensive field of study since it consists of many diverse scientific disciplines with interfaces to various fields of study, from the sciences to engineering and management. It is able to integrate the contributions of all the other engineering disciplines into a final, functional and marketable product, at the lowest possible cost.

Our researchers work in the following areas:

- Supply chain design methodologies
- Supply chain modelling and optimisation
- Intelligent logistics
- Humanitarian logistics
- Reverse supply chains
- Enterprise engineering
- Transportation development
- Large-scale, agent-based transportation modelling
- Commercial vehicle behaviour and risky driver behaviour
- Waste collection optimisation
- Data analytics
- Reliability engineering

LEARN MORE | www.up.ac.za/industrial-and-systems-engineering

WATCH | www.youtube.com/watch?v=WoXkTyGaMbA

CAREER OPPORTUNITIES

Qualified industrial and systems engineers can register as professional engineers (Pr. Eng.) after obtaining the required industry exposure. In addition to occupying highly satisfying professional positions, professional engineers can also undertake consultation work. Honours and master's degree programmes in the Department allow postgraduate students to obtain specialised knowledge in their chosen field, which will benefit them in their careers in industry. For those interested in an academic or research career, a PhD degree from the Department is an invaluable asset.

INDUSTRIAL AND SYSTEMS ENGINEERING IN PRACTICE

Industrial and systems engineers are planners, who determine the appropriate equipment, its location, how many of each type of equipment is needed, which technology should be used to produce how much of which product, when, by whom, and how it should be transported, which product the customer requires, where and how large the market for the product is, the acceptable quality, where the raw materials should be acquired, the acceptable price, how and in what quantities the product should be stored, how it should be financed and how often and in what manner the equpment should be maintained. They combine all the parts of a problem or a proposed solution, and the contributions of the other engineers, scientists and business people into one final working entity. As such, the industrial and systems engineer is one of the most important links in the productivity chain.

As a qualified industrial and systems engineer, you can create employment opportunities, or participate in industrial engineering activities in a wide range of sectors. This is because industrial and systems engineers bridge the gap between the technology-driven design engineer and the profit-motivated manager.

Your enhanced technological training and knowledge of economics, as well as your commitment to higher productivity and profitability, can help to bring the realities of the business world to the attention of all the other engineering disciplines. In this way, you will be equipped to exploit new employment opportunities in sectors that show significant growth.

DEPARTMENT OF MATERIALS SCIENCE AND METALLURGICAL ENGINEERING

OUR IMPACT

The research of EBIT's Department of Materials Science and Metallurgical Engineering aims to achieve optimised industrial processes and products, be it in minerals processing, the extraction of valuable metals or in the manufacture and fabrication of advanced alloys and products. Such process and product innovations are frequently aimed at the realities of South African plants and feedstocks, and result, among others, in the production of high-quality products through the innovative use of existing plants or available minerals. With regard to digital (4IR) manufacturing, research carried out in the Department aims to use laser-based and additive manufacturing technologies to produce innovative cutting-edge products. Our researchers work in the following areas:

- Minerals processing, with a particular focus on gravity separation and fines recovery
- Pyrometallurgy and pyrometallurgical modelling, with a specific focus on the Platinum Group Metals
- Hydrometallurgy, focusing on gold recovery and the development and recovery of next-generation battery materials
- Refractory materials
- Thermomechanical simulation of steel processes, from micro-alloyed to stainless steels
- Physical and mechanical metallurgy
- Welding engineering of advanced materials and repair of service-degraded alloys
- Additive manufacturing and laser processing
- Risk-based and forensic materials engineering
- Development of alloys resistant to hydrogen degradation
- Characterisation of materials degradation and corrosion, with a view to optimising resistance to degradation
- Light metals characterisation and development, including characterisation of environment-based degradation

CAREER OPPORTUNITIES

Qualified metallurgical engineers can register as professional engineers (Pr. Eng.) after obtaining the required industry exposure. In addition to occupying highly satisfying positions in technology or organisational management, professional metallurgical engineers often undertake consultation projects. Honours and master's degree programmes in the Department allow postgraduate students to obtain specialised knowledge in their chosen field, which will benefit them in their careers in industry. For those interested in an academic or research career, a PhD degree from the Department is an invaluable asset.

INDUSTRY CONTRIBUTION

The Department's research programme is focused on industrial and commercial problems facing the world today. It receives generous support from and has many healthy interactions with leading mining and metallurgical companies such as Anglo American, Kumba Iron Ore, Exxaro, Columbus Stainless, Sasol, ArcelorMittal SA and BHP Billiton.

One of the cornerstones of Industry 4.0 is advanced manufacturing processes and alloys. The South African government has invested significantly in establishing a local titanium industry, given the abundance of this mineral in South Africa. The Department plays an increasingly important role here with research contributions on light metal alloy development, powder metallurgy, investment casting and 3D printing. One example of this is additive manufacturing (3D printing) of titanium alloys for medical implants and aerospace applications.

LEARN MORE | www.up.ac.za/materials-science-and-metallurgical-engineering

#35 IN THE WORLD FOR MINERALS AND MINING ENGINEERING
(2023 QS World University Subject Rankings)

WATCH | www.youtube.com/watch?v=HGLqxpdXABY

DEPARTMENT OF MECHANICAL AND AERONAUTICAL ENGINEERING

OUR IMPACT

EBIT's Department of Mechanical and Aeronautical Engineering has made significant contributions to research in accurate solar heat flux distributions in concentrated solar power receivers, new terminology and flow regime maps for flow in the transitional flow regime, more nuclear accident-resistant fuel-cladding materials, and nanofluids and bio-nanofluids in terms of stability, thermal-fluid behaviour and heat transfer enhancement.

The Vehicle Dynamics Group has developed unique world-leading equipment and methods to parameterise large tyres for off-road vehicles. The testing and development of collision management systems for the mining industry are making a significant impact on reducing mobile equipment-related mining accidents.

In the Centre for Asset Integrity Management, important recent breakthroughs include the development of online turbine condition monitoring techniques based on blade tip timing, as well as the development of novel methods for the vibration monitoring of gears and bearings subjected to variable speed and load conditions. A unique feature of this research is the way in which signal processing techniques are combined with machine learning.

CAREER OPPORTUNITIES

Qualified mechanical engineers can register as professional engineers (Pr. Eng.) after obtaining the required industry exposure. In addition to occupying highly satisfying professional positions, professional engineers can also undertake consultation work. Honours and master's degree programmes in the Department allow postgraduate students to obtain specialised knowledge in their chosen field, which will benefit them in their careers in industry. For those interested in an academic or research career, a PhD degree from the Department is an invaluable asset.

Industry-related research is supported by Airbus, the American Society of Heating, Refrigeration and Air-Conditioning Engineers, the European Research Office of the US Army, EU Horizon 2020, and the Mine Health and Safety Council.

SPECIALISATIONS

Clean Energy Research Group
This group focuses on energy systems, renewable energy (solar, fuel cells, wind and ocean engineering), nuclear energy, energy efficiency and optimisation, heat exchangers, nanofluids, gas turbines and aerodynamics. Over recent years, there has been a growing research activity surrounding computational methods in the thermoflow field, with applications like electronics cooling and industrial computational fluid dynamics (CFD) gaining ground. The group is also actively involved in experimental heat transfer and fluid mechanics research.

Centre for Asset Integrity Management (C-AIM)
C-AIM explores a wide range of aspects pertaining to the structural integrity and performance of physical assets, such as power generation equipment, petrochemical plants, water utility equipment and mining equipment. Engineering assets are increasingly used past their original design lives. This happens in the context of growing safety and environmental concerns, as well as continuous financial pressure, and requires an in-depth understanding of all aspects of the asset management process.

Vehicle Dynamics Group
This research group exposes students to vehicle dynamics and mobility. It promotes the study, understanding and application of vehicle dynamics and mobility nationally and internationally through the South African version of the Baja SAE® competition in collaboration with local industry. The objective of its research is the improvement of vehicle safety, occupant safety, comfort, reliability and efficiency. Extensive use is made of experimental, as well as analytical and computational tools and techniques to achieve a deep fundamental understanding of vehicle dynamics.

LEARN MORE | www.up.ac.za/mechanical-and-aeronautical-engineering

WATCH | www.youtube.com/watch?v=n9oMl2mAp4o

DEPARTMENT OF MINING ENGINEERING

OUR IMPACT

EBIT's Department of Mining Engineering has contributed greatly to the South African mining industry by providing it with world-class leaders in mining engineering. The Department focuses on numerical modelling and rock engineering, rock-breaking, environmental management, mine design and mine management, as well as cutting-edge technological innovations brought about by the Fourth Industrial Revolution. In addition, the Department places great emphasis on the development of soft skills and leadership in line with the demands of the industry. Our researchers work in the following areas:

- Mechanisation and automation
- Management and leadership
- Rock engineering
- XR technology

CAREER OPPORTUNITIES

Qualified mining engineers can register as professional engineers (Pr. Eng.) after obtaining the required industry exposure. In addition to occupying highly satisfying professional positions, professional engineers can also undertake consultation work. Honours and master's degree programmes in the Department allow postgraduate students to obtain specialised knowledge in their chosen field, which will benefit them in their careers in industry. For those interested in an academic or research career, a PhD degree from the Department is an invaluable asset.

The Mining Alumni Society of the University of Pretoria (MASUP) is an active alumni body and social network for mining engineers in industry. Its members fill top industry positions and contribute to the work of the Department.

SPECIAL PROJECTS

South African Mining, Extraction, Research, Development and Innovation (SAMERDI)
The Department's longstanding association with the SAMERDI initiative has given rise to several projects in the Mechanised Mining Systems (MMS) programme. This collaborative venture with the Council for Scientific and Industrial Research (CSIR), the University of the Witwatersrand and the University of Johannesburg is coordinated by the Mandela Mining Precinct (MMP).

Murray & Roberts Chair in Industry Leadership 4.0
The research projects in leadership relevant to mining range from acceptance of technology by leaders to the safety and risk leadership that is required to navigate the impact of the 4IR on South African mining companies. The Department's Murray & Roberts Mining Engineering Leadership Academy (M&R MELA) is a critical part of exposing final-year mining engineering students to workplace leadership challenges and opportunities they will encounter once they enter industry.

XR technology
This research initiative (which operates in collaboration with EBIT's Department of Information Science) encourages interdisciplinary research in the field of extended reality (XR) that will benefit more than just the mining industry. The work in this field is supported by the Department's state-of-the-art Kumba Virtual Reality Centre for Mine Design.

"Educating and leading mining engineers to become imagineers."

#35 IN THE WORLD FOR MINERALS AND MINING ENGINEERING
(2023 QS World University Subject Rankings)

LEARN MORE | www.up.ac.za/mining-engineering

WATCH | www.youtube.com/watch?v=Rg0DIRIJl_s

DEPARTMENT OF ARCHITECTURE

OUR IMPACT

The Department of Architecture offers professional and research postgraduate programmes in the complementary fields of architecture, interior architecture and landscape architecture. Following an ecosystemic approach, the Department's three programmes and its research focus areas are mutually supportive and are often integrated into transdisciplinary research projects with partners in industry, government and local communities. The Department's research foci are built around the objective of creating resource-efficient, resilient and regenerative built environments, which respect both the landscape and the cultural context, improving ecological integrity, while contributing to a sense of meaningful place and social-ecological wellbeing within rapidly changing local and global contexts. Our researchers work in the following areas:

- Architectural education
- Smart cities
- Urban resilience (with a focus on food security, biodiversity and climate change adaptation)
- Designed ecologies
- Heritage and cultural landscapes
- Participatory architectural research and design as an instrument of urban citizenship
- Identity and meaning-making in place and space

TOP 240

IN THE WORLD FOR ARCHITECTURE AND BUILT ENVIRONMENT
(2023 QS World University Subject Rankings)

LEARN MORE | www.up.ac.za/architecture

WATCH | www.youtube.com/watch?v=qGV3gA0pssA

CAREER OPPORTUNITIES

Alumni of the Department are design thinkers. This is an increasingly valued skill in the business world. Honours graduates can register as senior candidate technologists or interior designers. To be a professional architect, interior architect or landscape architect, one must obtain the professional master's degree in one's chosen field. This is followed by a professional exam for which practical experience is required. Graduates can then register with the relevant professional or statutory bodies. Postgraduate qualifications are also a cardinal part of the pathway to academia.

SPECIAL PROJECTS

Unit for Urban Citizenship (UUC)
Intended as a platform for embedded participation, the mission of the UUC is to develop the scholarship of civil engagement and participatory development within the context of complex emergent African urbanism, and embed a culture of responsible and collaborative urban citizenship in graduates and the communities within which they work. This has become a vehicle through which collaborative community engagement work can be developed and researched.

Architectural Archives at UP
The Department hosts the most extensive and significant architectural archive in the country, including the office records of important South African architects such as Norman Eaton, Gawie Fagan, Helmut Stauch and Alan Lipman. The archive is used extensively for research by local and international scholars.

The Hatfield Digital Twin City initiative
The Department is actively involved in the exciting world of "digital twinning" – where reality and simulation meet in real time. It has contributed to the University's own comprehensive digital twin city: the Hatfield Digital Twin City. This long-term initiative will be a living laboratory that provides a fully simulated, mirrored image of Hatfield and its surroundings. By establishing thousands of real-time feedback loops between nature, environments, cities, people and processes, researchers can ask new kinds of curious and innovative questions.

PROFESSIONAL POSTGRADUATE DEGREES
In addition to its research programmes, the Department offers professional postgrduate degrees. These follow an approach of research-led design enquiry. The honours programmes are built around a series of interdisciplinary elective studios that require students to engage at a postgraduate level with group and individual projects that emphasise research, design and vision in real-life contexts. The professional master's programmes entail the completion of an individual design project informed by sound research using accepted research methodologies.

DEPARTMENT OF CONSTRUCTION ECONOMICS

OUR IMPACT

EBIT's Department of Construction Economics conducts research in the fields of construction management, quantity surveying and real estate. Our researchers work in the following areas:

- Project and facilities management
- Decision-making, real estate, feasibility studies, shopping centres
- Construction cost databases, escalation and indices.
- Life cycle costing, and standard documentation in construction
- Profiling and wellbeing in the built environment
- Short-term building insurance and building cost modelling
- Contracts and Property Law
- Building information modelling, VR and AR applications in construction
- Construction innovation and construction procurement
- Teaching, learning and human capital in the built environment
- Quantity surveying, public-private partnerships, 4IR, automation and robotics in construction, change management
- Future-proofing the real estate/construction industry, mobile applications (apps) in the property industry, nanotechnology in the built environment, blockchain in the property industry, drone technology in property development, sustainability and green buildings
- Cost prediction, AI strategies in quantity surveying
- Real estate, green buildings and life cycle costing

CAREER OPPORTUNITIES

With a qualification from the Department of Construction Economics, graduates can apply for professional registration in their field of specialisation. Honours and master's degree programmes in the Department allow postgraduate students to obtain specialised knowledge in their chosen field, which will benefit them in their careers in industry. For those interested in an academic or research career, a PhD degree from the Department is an invaluable asset.

PROFESSIONAL REGISTRATION AND ACCOLADES

The Department is a leader in the provision of well-prepared practitioners in the fields of construction, and property development and management in the private and public sector, both locally and abroad. Graduates in each of its three areas of specialisation can acquire professional registration, and its postgraduate academic programmes are accredited by industry bodies.

Quantity surveying
An honours degree in quantity surveying is required for a person to register as a professional quantity surveyor with the South African Council for the Quantity Surveying Profession. The Department's honours programme is accredited by the South African Council for the Quantity Surveying Profession (SACQSP) and the Royal Institution of Chartered Surveyors (RICS).

Construction management
An honours degree in construction management is required for a person to register as either a professional construction project manager or a professional construction manager with the South African Council for the Project and Construction Management Professions. The Department's honours programme is accredited by the South African Council for the Project and Construction Management Professions (SACPCMP), the Chartered Institute of Building (CIOB) and RICS.

Real estate
A three-year degree or an honours degree in real estate is required for a person to register as a professional property valuer with the South African Council for the Property Valuers Profession (SACPVP). A degree in MSc Real Estate by coursework can also lead to registration as a professional property valuer. The Department's degree programmes are accredited by SACPVP, and its master's programme is accredited by RICS.

LEARN MORE | www.up.ac.za/construction-economics

WATCH | www.youtube.com/watch?v=zlH-64qkCCM

DEPARTMENT OF TOWN AND REGIONAL PLANNING

OUR IMPACT

EBIT's Department of Town and Regional Planning is the research-driven consulting partner of a wide range of state and non-state entities. These range from The Presidency to provincial governments, research councils and municipalities. Its research has contributed to numerous legal and policy preparation and review processes. Our researchers work in the following areas:

- Reconsidering planning values, ethics, thought and language to facilitate radical spatial transformation
- Radical and innovative new planning methods to facilitate radical spatial transformation
- Planning in the context of climate change, plurality, scarcity, inequality and globalisation
- Different, diverse and novel understandings and interpretations of planning epistemologies and related philosophies and research approaches, styles and methods

CAREER OPPORTUNITIES

Town and regional planners are crucial contributors to the national pursuit of a better life for all by empowering people, enabling places, facilitating rapid, sustainable, shared, inclusive and equitable economic growth, and building robust, responsive and resilient institutions for service delivery and transformation, both in and outside the state. As such, graduates have access to a wide array of exciting career opportunities. To participate meaningfully in the profession, graduates must register as graduate planners with the South African Council for Planners (SACPLAN) and complete a minimum of three years in practice under a registered professional planner.

ACCOLADES FOR POSTGRADUATE PROGRAMMES

The Department's master's degree in Town and Regional Planning by coursework is accredited by the South African Council for Planners. Graduates have a high standing in practice, and despite tough economic times, in most cases find work soon after graduation. Graduates also have no difficulty finding employment in other parts of the world, and have left their footprint in a number of countries, including Angola, Australia, Canada, New Zealand, Nigeria, the Netherlands, the UK and the USA.

COLLABORATION

The Department places a strong emphasis on collaboration. Within the University, it engages in multidisciplinary and transdisciplinary research and cooperative projects. It has also formed strong relationships with other planning schools across the globe. In South Africa, the Department makes significant contributions to both the planning profession through training and capacity building, and civil society through government projects.

RADICAL SPATIAL TRANSFORMATION AND INCLUSIVE ECONOMIC GROWTH

The Department is focused on contributing to the crucially important pursuit of radical spatial transformation and inclusive economic growth in both urban and rural South Africa. It seeks to create, test and disseminate useful knowledge in this endeavour. The Department recognises the importance of collaborative work and research that assists in changing the world for the better and, as such, seeks to provide an intellectual and collegial home for students, researchers and lecturers who share these goals.

LEARN MORE | www.up.ac.za/town-and-regional-planning

WATCH | www.youtube.com/watch?v=qLA_R6Q0voA

DEPARTMENT OF COMPUTER SCIENCE

OUR IMPACT

EBIT's Department of Computer Science fulfils a vital role within the broader information technology (IT) spectrum in South Africa, as well as internationally. Its main objective is to explore and research the scientific basis of new technologies. It furthermore promotes the proliferation of reliable, robust and innovative computing and information technologies into the IT industry in South Africa.

Excellence in computer science education, the development of internationally and nationally recognised research initiatives and strong industry collaboration are the driving factors underpinning the success of the Department of Computer Science.

Our researchers work in the following areas:

- Artificial intelligence
- Computer and information security
- Digital forensics
- Computer science education didactics and applications
- System specifications and formal methods
- Software engineering and software architecture
- Data science

CAREER OPPORTUNITIES

In addition to its bachelor's degree in computer science, the Department also offers a cutting-edge undergraduate programme in information and knowledge systems.

Postgraduate degree programmes offered by the Department enable graduates to elevate their knowledge of their fields of specialisation in order to excel in their careers. Candidates who are interested in pursuing an academic career will be joining a cohort of world-renowned researchers.

The Department has a specialised postgraduate degree programme in Big Data and Data Science to address the need for capacity in this scarce skill arena. The University has existing world-class expertise in multiple disciplines that closely relate to Big Data and Data Science. This multidisciplinary degree programme is spread across a number of academic faculties and departments. Its focus is to provide educational opportunities at postgraduate level for researchers and practitioners in Big Data and Data Science to investigate needs in both South Africa and the international landscape. Graduate professionals from industry can leverage this degree to reskill themselves in the building blocks of Big Data and Data Science, while researchers can excel in related research projects. The degree forms part of the Faculty's Big Data Science strategic initiative

RESEARCH EXCELLENCE

The Department has established itself as a very strong research entity both nationally and internationally. It is ranked among the **top 1%** of Computer Science departments in the world based on citations of its research outputs ***(Essential Science Indicators).***

The University of Pretoria is unique in administering the fields of information science, informatics (information systems) and computer science from within a single School of Information Technology.

LEARN MORE | www.up.ac.za/computer-science

TOP 550 IN THE WORLD FOR COMPUTER SCIENCE AND INFORMATION SYSTEMS
(2023 QS World University Subject Rankings)

WATCH | www.youtube.com/watch?v=9bH0K_hIuc0

DEPARTMENT OF INFORMATICS

OUR IMPACT

EBIT's Department of Informatics focuses on contributing to research on information systems in organisations and education, and on developing contexts. Its research relates to information technology management, information systems in education, ICT for development, human-computer interaction and data science management. Our researchers work in the following areas:

- Information technology management
- Information systems in education
- Information and communication technologies for development (ICT4D)
- Human-computer interaction
- Data science management and applied data science

CAREER OPPORTUNITIES

The Department of Informatics offers the BCom (Informatics) degree, as well as a cutting-edge undergraduate programme in information systems. The BCom (Informatics) degree is the only information systems degree in Africa that is accredited by the Computing Accreditation Commission (CAC), operated by the International Accreditation Board for Engineering and Technology (ABET). This gives the Department's graduates international recognition.

With an honour's degree in either informatics or information systems, students will have advanced knowledge, skills and research experience relating to key aspects of information systems, including enterprise architecture, human-computer interaction, disruptive technologies, mobile computing, e-commerce, advanced database systems, knowledge acquisition and sharing, data mining and information systems development. The master's degree programmes comprise a full dissertation on a selected topic related to the key research areas of the Department.

UNIQUE OPPORTUNITIES

Postgraduate Diploma in Digital Innovation
With this diploma, students will have knowledge, skills and research experience relating to aspects of digital innovation, including human-computer interaction, disruptive technologies, and information and communication technologies for development.

MIT Information Communication Technology Management
Graduates of this degree programme will have the knowledge and skills to manage and lead information and information technology-related activities in an organisation in strategic, operational and project environments. Half of the degree comprises coursework, while the other half comprises a mini-dissertation.

iSCHOOLS

EBIT's Department of Informatics forms part of the iSchools Organization, an international group of information schools dedicated to advancing the information field.

Modern organisations cannot function without information and the technology with which they gather, store, compute and make available the information. The successful application of technology is, however, more than just writing computer programs. Computer programs are important, but an understanding of the business within which the organisation functions and an understanding of the use of information and information technology to support the objectives of the organisation are far more important. Informatics graduates are essential to this field.

LEARN MORE | www.up.ac.za/informatics

TOP 550

IN THE WORLD FOR COMPUTER SCIENCE AND INFORMATION SYSTEMS
(2023 QS World University Subject Rankings)

DEPARTMENT OF INFORMATION SCIENCE

OUR IMPACT

EBIT's Department of Information Science is concerned with how information is generated, organised, circulated and used in society. In today's knowledge economy and 4IR, information is a currency that is shared in written, audio and visual form, and in print and digital formats.

The Department houses programmes three unique information-related fields: information science, multimedia and publishing.

Our researchers work in the following areas:

- Knowledge management and competitive intelligence
- Information processes
- Meta-context of information
- Book and publishing studies
- Information ethics
- Virtual reality (VR)/augmented reality (AR)
- Interaction design and user experience design
- Game studies, serious games and gamification

CAREER OPPORTUNITIES

Students have the opportunity to enrol for an undergraduate programme in one of the Department's three fields of specialisation. These programmes produce industry-ready graduates. Postgraduate degree programmes offered by the Department enable graduates to elevate their knowledge of their fields of specialisation in order to excel in their careers. Candidates who are interested in pursuing an academic career will be joining a cohort of productive researchers. Staff members of the Department collaborate with researchers in a number of countries in Europe (Finland , Germany and Sweden), the UK, the USA, Israel and Australia, and have served on the boards of a number of scholarly associations and academic journals.

In industry, information science graduates typically function as information managers, information specialists, information consultants, information brokers and systems specialists.

Multimedia graduates acquire the theoretical and technical know-how to build information products that use a variety of media and delivery systems. They can work in industries such as telecommunications, broadcasting, publishing and internet content provision, or at any institution that communicates information in multimedia.

Publishing graduates typically find employment opportunities in copy-editing and proofreading, design and typesetting, market research, copyright negotiations, book marketing and promotion, and bookselling or distribution.

ACCOLADES FOR ACADEMIC PROGRAMMES

The Department's lecturers are involved in a variety of industry bodies and associations. This close association keeps the programmes relevant. These organisations include the International Federation of Library Associations and Institutions (IFLA), the Library and Information Association of South Africa (LIASA), the Association for Information Science and Technology (ASIS&T; Board of Directors and Executive), scholarly committees such as Information Seeking in Context (ISIC) and the Association for Library and Information Science Education (ALISE).

Its academics have also had a direct impact on policy-making, serving on the Department of Arts and Culture's Library and Information Services Transformation Charter and the National Council of Library and Information Services (NCLIS).

The Publishing Studies team conducts industry-related research on behalf of the Publishers' Association of South Africa (PASA) and the South African Booksellers' Association (SABA). It also works with the Association of Publishing Educators, based in the UK.

LEARN MORE | www.up.ac.za/information science

READ ABOUT OUR VIRTUAL REALITY INTERACTION LAB www.vri.up.ac.za

WATCH | www.youtube.com/watch?v=Xwz_TQYTssU


Jan
Feb
March
April
May
210.95
149.16
23.26
1.41%
18.92

GRADUATE SCHOOL OF TECHNOLOGY MANAGEMENT

OUR IMPACT

The Graduate School of Technology Management (GSTM) houses EBIT's Department of Engineering and Technology Management. In this department, a strong focus is placed on high-quality research and excellent teaching and education. Research ensures relevance to the market in terms of increased national and international competitiveness, optimising product life cycles, technology transfer and the positioning of technological abilities within the international context.

Our researchers work in the following areas:

- Technology and innovation management
- Project management
- Engineering management
- Energy and systems analysis

LEARN MORE | www.up.ac.za/gstm

CAREER OPPORTUNITIES

Engineering and technology management at honours level
The honours programmes in engineering and technology management provide the first step towards technical management and expose the young graduate to the management of technology. They are aimed at engineers and scientists who have recently completed a bachelor's degree and who might have insufficient work experience or require an entry qualification to enrol for a master's degree in the technical management sciences. By successfully completing an honours programme, young engineers and scientists should have improved their ability to manage technology and have the knowledge to develop and deploy technology innovations.

Engineering management at master's and doctoral level
Engineering management is the application of technology and other resources in engineering to provide products, systems and services for financial gain in the marketplace. The master's programmes aim to provide relevant management education to the practising engineer or scientist who is active primarily in technology-based enterprises. They focus on the process of value creation, i.e. product and system development, production and operations, and the maintenance of systems and related services in a business context. The question of strategically positioning the enterprise in terms of technological capability is paramount. These study areas distinguish our programmes from other postgraduate and business management degrees. At doctoral level, researchers can join the Engineering Management Research Group, which focuses on systems engineering and related fields.

Project management at master's and doctoral level
Project management continues to be one of the most sought-after skills in the modern professional society. The master's programmes empower graduates to apply scientific thinking and advanced interdisciplinary skills to manage projects over the project life cycle. They facilitate learning the fundamentals of project management so that learners can identify, develop, implement and close projects. They view projects as strategic initiatives with modules that consider the environment, people and the realisation of benefits. At doctoral level, researchers can join the Project Management Research Group, which focuses on project communication, agile and services project management, portfolio management, project knowledge management, project governance, project readiness and methodologies, project risk management and organisational project management.

Technology and innovation management at master's and doctoral level
The technology and innovation management programmes introduce students to the aspects of technology that support the long-term goals of innovation and productivity within an organisation. The focus is on the introduction of new products, processes, services or systems to an organisation through the economic development and transfer of knowledge on the choice and application of technology and processes to secure the organisation's growth, competitiveness and sustainability. At doctoral level, researchers can join the Technology and Innovation Management Research Group, which focuses on technology and knowledge management, innovation management, technological entrepreneurship and commercialisation, technology and innovation strategy, and future studies, as well as science, technology and innovation policy.

While technology is the catalyst for change, humans are the sustaining force. This means that we need to develop new mindsets and find new ways of working. If you are an independent thinker who is eager to discover and create new knowledge that will make a difference in your community and in the world, then EBIT is a place where you can excel.

APPLY NOW TO JOIN THE EBIT GENERATION | www.up.ac.za/faculty-of-engineering-built-environment-it/article/2952341/preview?module=cms&slug=content-item&id=2952341

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