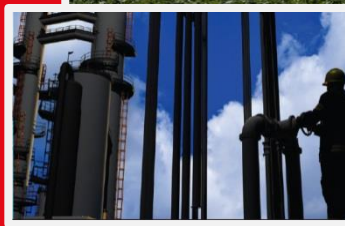
UNIVERSITY OF KWAZULU-NATAL
INYUVESI YAKWAZULU-NATALI

Exploring careers in Engineering



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What is an Engineer?

Wikipedia provides a well-rounded definition of an engineer as "… a professional practitioner of engineering, concerned with applying scientific knowledge, mathematics, and ingenuity to develop solutions for technical problems. Engineers design materials, structures, and systems while considering the limitations imposed by practicality, regulation, safety, and cost. The work of engineers forms the link between scientific discoveries and their subsequent applications to human needs and quality of life. … Many engineers use computers to produce and analyse designs, to simulate and test how a machine, structure, or system operates, to generate specifications for parts, to monitor the quality of products, and to control the efficiency of processes."

- (Extracted from Wikipedia http://en.wikipedia.org/wiki/Engineer)

What Is the Difference Between a Scientist and an Engineer?

Many people struggle to understand the difference between a scientist and an engineer. The About Com website provides a helpful clarification: while scientists tend to explore the natural world to discover new knowledge, and how it works, engineers apply that knowledge to solve practical problems. However, there is an overlap between science and engineering, in that scientists could apply science to solve problems and engineers could make important scientific discoveries.

- (About com http://chemistry.about.com/od/educationemployment/f/scientistvsengineer.htm)

More about Engineering Education

Engineering, like science, is sub divided into major branches and interdisciplinary, specialised areas of focus. For example, mechanical, electrical and civil engineering are traditional, major branches of engineering. A combination of these branches, along with agricultural sciences, form agricultural engineering, which is an example of an interdisciplinary, specialised area.

- In South Africa, the Engineering Council of South Africa (ECSA) is a statutory body that guides and regulates the training, registration and practice of engineers. Engineering education at UKZN is accredited by ECSA. It is also, through ECSA, recognised by the international Washington Accord, which allows for registration as a professional in many countries abroad.
- At UKZN, seven Engineering degree programmes are offered, namely: agricultural, chemical, civil, computer, electrical, electronic, and mechanical engineering. The degree in engineering is a full-time, four-year, honours-equivalent, professional bachelors degree (part-time study is not available).
- The programme is a difficult and densely-packed curriculum that requires an excellent foundation in language and science, an ability to apply this knowledge to solve practical problems, and immense application in time and effort, on the part of the student.
- In a typical four-year curriculum, the first two years are spent studying mathematics, basic sciences, and introductory engineering, which provide a foundation for more advanced engineering. Some modules in the social sciences or humanities are also required. A design course, computer skills, workshop and laboratory classes also form part of the curriculum.

Engineers in the Workplace

- Most engineers work in office buildings, laboratories, or industrial plants. Others may spend time outdoors at sites of construction and natural resources exploration, in the agricultural environment and in sites of production, where they monitor or direct operations or solve onsite problems. Some engineers travel extensively in order to do their work.
- Many engineers work a standard 40-hour week. At times, deadlines may require longer hours.
- Beginning engineering graduates usually work under the supervision of experienced engineers and, in large companies. They frequently receive additional formal training.
- As new engineers gain knowledge and experience, they are assigned more difficult projects with greater independence to develop designs, solve problems, and make decisions.
- Engineers may advance to become technical specialists or to supervise a staff or team of engineers and technicians. Some may eventually become engineering managers or enter other managerial or sales jobs.
- It is important for engineers, as it is for those working in other technical and scientific occupations, to continue their education throughout their careers because much of their value to their employer depends on their knowledge of the latest technology.
- Engineers trained in one branch may work in related branches. For example, many aerospace engineers have training in mechanical, chemical or electronic engineering, industrial and mining engineers in mechanical or electrical engineering. This flexibility allows employers to meet staffing needs in new technologies and specialties in which engineers may be in short supply. It also allows engineers to shift to fields with better employment prospects or to those that more closely match their interests. In addition, many high-level executives in government and industry began their careers as engineers.

  - (Extracted and revised from the College Grad website http://www.collegegrad.com/careers/proft06.shtml)

The Skills and Traits Required for Engineering Careers

An engineer should:

- have an excellent grasp of the necessary concepts in Mathematics, Physics and Chemistry, plus language skills.
- have aptitude for, and scientific interest in, how both living and mechanical things are constituted and how they function.
- have the ability and the desire to identify, analyse and solve problems, to be logical and practical, and yet inventive and innovative, creative and analytical.
- have good oral and written communication skills and be able to work well in a team.
- have an excellent aptitude for computing and design.
- have the ability to work without supervision and accept responsibility – a disciplined self-starter who is able to apply oneself and who will work on a problem until it is solved.
- to be enthusiastic, and to have perseverance and patience with details and precision.

  - (Extracted and revised from the College Grad website http://www.collegegrad.com/careers/proft06.shtml).

Entry Requirements
Compulsory Subjects and requirements:

- 70% (6) for Mathematics (algebra, geometry, trigonometry, and calculus)
- 70% (6) Physical Science
- 50% (4) for English
- minimum of 33 matric points.

It must be noted that these are the minimum entry requirements. Some fields of engineering are very sought-after and admission is therefore competitive.

Alternative Access to Engineering
There are limited alternative access routes for admission to engineering: the School of Engineering's alternative access Foundation programme ; for students from disadvantaged backgrounds.

Compulsory Subjects and requirements for entry to the Foundation programme:

- 50% (4) for Mathematics
- 50%(4) Physical Science
- 50%(4) English
- Quintile 1, 2 or 3 School (as rated by the Department of Education)

AGRICULTURAL ENGINEERING

- Agricultural Engineers apply principles of science and technology to solve problems relating to agriculture, forestry and harvesting, and the post-harvest handling and processing of agricultural products.
- Agricultural Engineering is a specialisation that combines a number of fields of engineering with knowledge of agriculture, processing engineering, soil science and hydrology. They manage living things and life-giving resources by using **mechanical, civil and electrical engineering** skills.
- Agricultural Engineering provides challenging career opportunities in various fields such as research and development, food processing, manufacturing, water resources, governmental and environmental agencies, professional consulting, business management and academic careers.
- Agricultural Engineers can design such things as agricultural equipment and systems, storage and processing facilities and water-storage and irrigation facilities, to name but a few.
- The demand for Agricultural Engineers exceeds the supply. Leading agricultural firms, government services, and consulting agencies seek after graduates.
- An Agricultural Engineering degree will provide opportunities by find employment around the world in large corporations and small businesses.
- UKZN is the only institution in South Africa that offers a Bachelor of Science in Agricultural Engineering

Areas of Specialisation in Agricultural Engineering include:

- **Water supply and irrigation:** Agricultural Engineer are involved in hydrology and farm dam design; canal, pipeline and pump systems; sprinkler, drip and micro-irrigation systems; mechanised irrigation; surface irrigation; and drainage.
- **Agricultural mechanisation:** Agricultural Engineers assist producers, contractors and farmers with the development of new machinery; design of agricultural equipment; planning and evaluation of mechanisation systems; agricultural energy research and consultation; and appropriate technology for developing areas.
- **Soil conservation**: Agricultural Engineers plan and design conservation and reclaiming structures; systems for the safe discharge of flood water; contour and other appropriate cultivation systems to safeguard vulnerable agricultural lands against erosion and specially adapted farming practices to enhance soil conservation.
- **Agricultural buildings and structures:** Agricultural Engineering work in a team to design buildings fit to house the industrial processes for the intensive production of meat, dairy products, poultry and eggs; buildings with controlled environments such as green- and glass- houses, nurseries, and aquaculture; buildings for the storage and processing of products such as grain silos and dryers for maize, tobacco and fruit; and plastic sheeted tunnels for intensive cultivation of flowers and vegetables.
- **Food and fibre processing:** Agricultural Engineering can specialise in food and fibre processing. Processing involves the preparation of commodities from organic matter. Agricultural engineers guide entrepreneurs in the following types of processes: drying, milling, mixing, compacting, cooling, heating and liquidising of agricultural products; handling, storage, transportation and packing systems, for example, of fruit, vegetables and meat.

The Bachelor of Science in Engineering Degree (BScEng)
The degree of Bachelor of Science in Engineering in the field of Agricultural Engineering is an Honours equivalent, professional Bachelors degree that extends over four years. It is offered in the School of Engineering within the College of Agriculture, Engineering and Science. Instruction is through lectures, tutorials and laboratory practicals. Extensive use is made of computers in well-equipped facilities.

CHEMICAL ENGINEERING

Chemical engineers are concerned with the design, construction, and operation of industrial plants in which materials undergo physical and /or chemical change.

The understanding of a world in which solids, liquids, gases, energy and machinery all interact requires a very broad scientific background. Chemical engineers learn to describe the many common features of these processes mathematically, leading to alternative designs, optimal computer control, or the solution of process problems. These concepts have proved to be very powerful, and chemical engineers have made contributions in fields as varied as medicine and geology, biology and astrophysics.

Traditional employers like the mineral, chemical, plastic, fuel, pulp, sugar, fertilizer, cement, soap and water industries are being joined by manufacturers of fine chemicals, pharmaceuticals, food, biochemicals and semi-conductors. The chemical engineer is often the key link in communication between members of other specialized professions in large multi-disciplinary projects. The increasing demand for commodities will require further large-scale development of our fuel, mineral and chemical industries.

Chemical Engineers may find themselves in any one of the following fields:

- **Research & Development**
  Here the engineer is concerned with ways of improving the efficiency and productivity of existing processes, or the development of completely new processes and products.

- **Project Evaluation & Design**
  Should an existing plant need to be extended or replaced it is the chemical engineer who would be required to evaluate the commercial prospects and technical feasibility of the proposals. The design of a new plant using a different production process would also be carried out by chemical engineers.

- **Project Management**
  Once it has been decided to proceed with a new plant project, a manager, often a chemical engineer, will be appointed. The task will be to ensure that the erection and commissioning of the new plant will proceed as smoothly and speedily as possible from the design stage to the start of production.

- **Production Management**
  Here the task of the engineer is to overcome day-to-day operational difficulties, improving production efficiencies, and optimizing the utilization of the available plant.

- **Consultants**
  Chemical engineers can operate as independent consultants once they have gained experience in production and plant design, particularly now that powerful PC's are available for specialized calculations.

- **General Management**
  Chemical engineers find themselves well placed to handle the additional interactions of people, money and markets in senior management positions. Advancement is usually rapid and promotion to senior management is common.

The Bachelor of Science in Engineering Degree (BScEng)

The degree of Bachelor of Science in Engineering in the field of Chemical Engineering is an Honours equivalent, professional Bachelors degree that extends over four years. It is offered in the School of Engineering within the College of Agriculture, Engineering and Science. Instruction is through lectures, tutorials and laboratory practicals. Extensive use is made of computers in well-equipped facilities.

CIVIL ENGINEERING

Civil Engineers plan, design, construct and manage the physical infrastructure and facilities needed for the optimal functioning of human settlements, society and commerce.

Typical examples of Civil Engineering are:

- **Structures**, such as tower blocks (skyscrapers), bridges, power stations, sports stadiums and oil rigs.
- **Transport Systems**, for example roads, railways and airports.
- **Water Supply Systems**, including dams, reservoirs and water towers.
- **Marine Works**, such as seawalls, harbours and dry docks.
- **Solid and Liquid Waste Disposal,** including environmental considerations and waste to energy production.

In summary, the Civil Engineer needs to understand and integrate the natural environment with the requirements of people and engineering science in order to design and construct solutions that provide infrastructure and services, using the best available design and technology.

Civil engineering solutions, in the form of water supply, drainage and sanitation infra-structures increase the quality of life by eliminating the sources of infections and diseases. Problems of traffic congestion require the development of new, mass transportation systems. While extreme weather events, and forms of unrest, require structural design solutions. All of these play their part in the shortage of Civil Engineers.

A Civil Engineer therefore requires a holistic (all embracing) outlook, a creative, scientific and logical mind, and good communication skills. International surveys have shown that Civil Engineering is one of the highest rated professions in terms of job satisfaction.

Career Prospects in Civil Engineering

Many Civil Engineers are employed in the Public Sector. Examples include Water Affairs and Forestry and the Roads Department, ports and railways, municipalities, the CSIR (researchers), and Universities. Construction Contractors are also a large employer group. The remaining graduates are employed in consulting companies.

The Bachelor of Science in Engineering Degree (BScEng)

The degree of Bachelor of Science in Engineering in the field of Civil Engineering is an Honours equivalent, professional Bachelors degree that extends over four years. It is offered in the School of Engineering within the College of Agriculture, Engineering and Science. Instruction is through lectures, tutorials and laboratory practicals. Extensive use is made of computers in well-equipped facilities.

- **Year 1: Advanced Science and Mathematics**
  The first year concentrates on physics, chemistry and mathematics to provide a solid scientific foundation. Additionally, an introduction is given to communication, drawing and the design process.
- **Year 2: Mathematics and Introduction to Civil Engineering**
  Mathematics continues to be taught in the second year but the application of scientific principles is introduced by way of the major Civil Engineering subjects of Fluids, Geotechnics and Structures together with Engineering Materials and Surveying.
- **Year 3: Engineering Theory**
  The third year involves a development of the theoretical basis of Civil Engineering through the application of scientific principles – primarily in the disciplines of Fluids, Geotechnics and Structures.
- **Year 4: Engineering Practice**
  In the final year, attention is focused on the application of engineering theory to resolving practical Civil Engineering problems. This culminates in students undertaking extensive design and investigative projects. The major subjects; Fluids, Transport, Geotechnics and Structures are complemented by other modules – such as Environmental Management, Environmental Technology and Professional Practice.

COMPUTER AND ELECTRONIC ENGINEERING

How do I distinguish between Electrical, Electronic and Computer Engineering?

- Electrical Engineering is a traditional, early branch of engineering concerned with the generation and distribution of power. Electrical power is generated from a variety of sources, such as rushing water, coal and nuclear power. Distribution is undertaken via transmission lines and sub-stations that transport bulk electricity from the power generators and storage facilities to the users.

- Electronic Engineering is generally viewed as a sub-division of Electrical Engineering. It uses scientific knowledge to create components, devices, systems or equipment that use electricity as a source of power. These components include capacitors, diodes, resistors and transistors

- The difference between Electrical and Electronic Engineering lies in the generation and distribution of electricity (electrical engineering), as distinct from Electronic Engineering's concern with the storage, retrieval, transfer and processing of information utilising computers, software, transmission networks, telephones, radio, television, signal processing and optics.

- Electrical Engineering is often called "heavy current" engineering, Electronic Engineering is referred to as "light current" engineering.

- Computer Engineering is a further specialisation focussing specifically on the applications of computer technology.

Computer Science vs Computer Engineering
There is some overlap between a degree in Computer Science (BSc) and in Computer Engineering (BScEng). On the career information site of the University of Buffalo, Computer Science is defined as:

"…the systematic study of algorithmic methods for representing and transforming information".

Computer Engineering, on the other hand, is **"…the design and prototyping of computing devices and systems",** concentrating on the application of computing.

(University of Buffalo http://www.eng.buffalo.edu/)

- While the computer scientist tends to concentrate on the science of computer software, the computer engineer is more focussed on applying these findings, via hardware and systems design.
- The term hardware refers to all physical aspects of the computer, such as central processing units (CPU's) computer chips, microprocessors, custom integrated circuits, and peripherals such as disc drives, scanners, and modems.
- Computer Engineers also develop special purpose 'embedded' products that use computer technology. Embedded computer technology is used in applications ranging from refrigeration equipment to car engines and aeroplanes.

Careers in Electronic and Computer Engineering
Almost every modern human activity is facilitated by the use of electronic devices, including telecommunications, radio and satellite communications, automation and instrumentation, navigation and data processing. Both electronic and computer engineers will work in similar environments.

The fields of Electronic and Computer engineering include the following:

- Artificial Intelligence - developing computers that simulate human learning and reasoning ability.
- Computer Architecture - designing new computer instruction sets, and combining electronic or optical components to provide powerful but cost-effective computing.
- Telecommunications – satellite and telephone signal networks and technology.

The Bachelor of Science in Engineering Degree (BScEng)
The degree of Bachelor of Science in Engineering is an Honours equivalent, professional Bachelors degree that extends over four years. Instruction is through lectures, tutorials and laboratory practicals. Extensive use is made of computers in well-equipped facilities.

COMPUTER ENGINEERING

Computer Engineering is a fast growing field of engineering where computer systems are applied to the management, control and dissemination of information and the control and management of systems of all forms.

Career Opportunities

Computer Engineers design and manage computer systems from small LANs to networks that span the world, connected via cables, optical fibres and radio and satellite links. Computer networks are the backbone on which our economy is based.

The work of a Computer Engineer is very similar to that of an electronic engineer, but the computer engineer specialises in all aspects of computing such as operating systems, software engineering, computer hardware, computer and network security and network design. The strong foundation on subjects such as software engineering, network and computer security, design and analysis of complex systems, Internet engineering and e-commerce are what provides the computing specialisation.

Electronic equipment today relies very heavily on computer technology and so the two types of engineers work together to design and manufacture electronic equipment which requires both hardware and software design. Computer Engineers are employed by a wide range of companies such as:

- Telkom, Vodacom, MTN, Cell C
- SABC, Orbicom, Sentech
- CSIR, SABS, Armscor
- mines, defence industry, electronic manufacturing industries, computer companies, software houses, consulting firms or
- You could be self-employed running your own business in many of these fields.

The Bachelor of Science in Engineering Degree (BScEng)

The degree of Bachelor of Science in Engineering in the field of Computer Engineering is an Honours equivalent, professional Bachelors degree that extends over four years. Instruction is through lectures, tutorials and laboratory practicals. Extensive use is made of computers in well-equipped facilities. To enable the integration of the theory with the practice of engineering, the student is required to complete a minimum period of 13 weeks of work in industry.

The programme enables students to specialize in the fields of the hardware and software design of computer and embedded systems. It also provides a solid background in Electronics, Control and Telecommunications. The foundation subjects common to Computer, Electrical and Electronic Engineering Programmes, are offered during the 1st, 2nd and part from 3rd years of study. The specialization subjects start in 2nd year with 2 modules on Data Structures and Algorithms. In the third year of study, further specialist modules in Software Engineering, Advanced Programming and Discrete Mathematics are taken along with two Computer Engineering Design modules.

The 4th year of study is where most specialisation takes place with prescribed modules on Advanced computer Engineering, Embedded Systems, Operating Systems, Internet Engineering and Real Time Computing, plus three optional modules taken from subjects such as E-Commerce Systems, Security and Encryption, VLSI Design, Artificial Intelligence, and Image Processing and Distributed Computing. The students also undertake two Computer Engineering design projects.

Students also attend a module on Engineering Management and Labour Practices in preparation for the management role they will assume in industry and an Environmental Engineering module to ensure sensitivity to this important aspect of any engineering.

A student is expected to be capable of accurate and analytical thought, and to possess motivation, creativity and technical aptitude, along with ability in Mathematics and Science at school.

ELECTRONIC ENGINEERING

The field of electronic engineering is concerned with the extensive discipline of electronic information handling, which has become crucial to the promotion of efficiency and productivity in so many facets of both commercial and industrial life. This includes all aspects of telecommunications, the design of computers and microcomputer systems, microwave engineering, electronic equipment manufacture, and many other similar activities.

Career Opportunities

Electronic Engineers are responsible for the design, management and specification of an almost endless list of hi-tech appliances, equipment and systems. Some examples of these would be: cellular and land-line telephones and networks, satellite transmitters and receivers, global positioning systems, CD and DVD players, Hi-Fi equipment, computers and software, high speed fibre optic communications links as well as television and radio transmitters and receivers. In fact one would be hard pressed to find a device today that has not been improved by some electronic engineering innovation.

Almost all electronic design and evaluation work will be completed using computers and as with all engineering a significant amount of time will involve the use and programming of computers. Electronic Engineers are employed by a wide range of companies such as:

- Telkom
- MTN, Vodacom, Cell C
- SABC
- Armscor, CSIR, SABS
- mines, defence industry, electronic manufacturing industries, computer companies, software houses, consulting firms, or
- You could be self-employed running your own business in many of these fields.

The Bachelor of Science in Engineering Degree (BScEng)

The degree of Bachelor of Science in Engineering in the field of Electronic Engineering is an Honours equivalent, professional Bachelors degree that extends over four years. Instruction is through lectures, tutorials and laboratory practicals. Extensive use is made of computers in well-equipped facilities. To enable the integration of the theory with the practice of engineering, the student is required to complete a minimum period of 13 weeks of work in industry.

The degree has an emphasis on the principles of electronic communication, while at the same time permitting a wide range of different applications of electronics to be studied. For example, in the third year, the curriculum includes such modules as *Digital Systems, Electromagnetic Theory, Physical Electronics, Control Systems* and *Power Electronics*.

Approximately 15% of the total academic load is on engineering design in which students are involved in team and individual projects. Students also cover detailed aspects of electronic engineering such as:
Digital Communications, Digital Processes, Digital Signal Processing, and *Embedded Systems*. A number of optional modules are also offered. These include: *Acoustics, Artificial Intelligence, Microwave Engineering, Superconductivity, Data Communications, Image Processing, Automation* and *Power Electronics.* Students attend modules on *Engineering Management and Labour Practices, Engineering Business and Engineering Entrepreneurship,* in preparation for their professional lives.

A student is expected to be capable of accurate and analytical thought, and to possess motivation, creativity and technical aptitude, along with ability in Mathematics and Science at school.

ELECTRICAL ENGINEERING

The electrical engineering curriculum is designed to prepare the student for the environment in which the generation, transmission and use of electrical power takes place. This environment varies from large generators in a power station to the latest microprocessors used to control a process in a factory or the supply of electricity to a house.

The degree builds on a broad base of science and general engineering in the first two years with an increasing level of specialisation in electrical engineering in the final two years. In the third year, the curriculum includes modules such *as Electromagnetic Theory, Electrical Machines, Power Systems, Electronics, Digital Systems, Power Electronics* and *Control Systems.* Electronics and micro-processors are included in the curriculum because of their vital role in modern electrical engineers practice. Computer based software tools are widely used throughout the degree.

Students also attend modules on *Environmental Engineering*, *Engineering Business*, *Engineering Entrepreneurship*, *Engineering Management and Labour Relations*, and complementary studies courses to prepare them for the leadership roles they will assume in industry. The remaining module credits required are selected from a wide range of options to suit a student's specific interests and chosen career specialization area. These options address issues likely to be experienced in practice and so familiarize the future graduate with problems that will be faced in industry. Options that may be offered include *High Voltage Engineering, Power Systems, Power Electronics, Electrical Machines, Control Systems, Automation, Digital Signal Processing, Embedded Systems,* and *Illumination*.

CAREER OPPORTUNITIES

Electrical Engineers are employed in a wide range of fields from designing the very large machines and equipment used to generate electrical energy and transmit it throughout the country, to the design of the electrical equipment and systems that use this energy in almost every sphere of the economy: mining and industry, rail transportation, automated production lines, and the lighting and heating of homes and shopping malls.

To make these things happen electrical engineers must not only understand the principles of operation of electric machinery such as generators, motors and transformers, but also must know how to combine these machines into large and complex systems capable of operating efficiently. Due to the complexity of modern electrical machines and technology, computers are increasingly used by electrical engineers, both as tools for designing and analysing electrical systems and for automation and control of the systems themselves once they go into operation. Computers and IT are therefore very much a part of electrical engineering.

There are many large and small organisations, which depend upon a steady stream of new engineers to meet their needs. If you decide to be an Electrical Engineer you could be employed by companies such as: Eskom, Spoornet, Sasol, AECI, CSIR, Mittal or Highveld Steel, Mondi or Sappi, Hulett or Illovo Sugar, mining companies, municipalities, processing industries, consulting firms. Many electrical engineers are self employed as consultants.

The Bachelor of Science in Engineering Degree (BScEng)

The degree of Bachelor of Science in Engineering in the field of Electrical Engineering is an Honours equivalent, professional Bachelors degree that extends over four years. Instruction is through lectures, tutorials and laboratory practicals. Extensive use is made of computers in well-equipped facilities. To enable the integration of the theory with the practice of engineering, the student is required to complete a minimum period of 13 weeks of work in industry.

A student is expected to be capable of accurate and analytical thought, and to possess motivation, creativity and technical aptitude, along with ability in Mathematics and Science at school.

LAND SURVEYING / GEOMATICS

The Bachelor of Science in Land Surveying is a four-year, honours-equivalent, professional Bachelors degree. It is accredited towards registration as a professional land surveyor. It also covers closely related areas such as geographical information systems (GIS), land information systems (LIS), and global positioning systems (GPS). These subjects are part of a growing science of geomatics.

Our graduates are sought after by both private firms of land surveyors, and government departments. Many work overseas and in other African countries. Future graduates could be involved in land development and management, geographic information systems, engineering surveys, applied computing and hydrographic surveys.

Geomatics

Geomatics is a new word {not found in the Oxford dictionary}, and is derived from the word *geo*, meaning of the earth, and *informatic*s, which is the science of disseminating information. The recent introduction of geomatics is because of the "digital revolution" which has transformed the instruments and methods of presenting and transmitting information.

The Bachelor of Science in Land Surveying

The Bachelor of Science in Land Surveying is only offered by two Universities in South Africa. At the University of KwaZulu-Natal it is a small yet vibrant programme which offers its students the advantages of close contacts with their lecturers and fellow students. In addition to the academic requirements, during our annual survey camps for first, second and third year of study, students are involved in practical work to support development of our National Nature Reserves throughout the Province of KwaZulu-Natal.

- The first year of study involves mainly foundation courses common to engineering students (maths, applied maths and physics). Students also acquire basic geomatics and computing skills.
- During the second and third years students deepen their skills in geomatics, land rights and town planning so that they are able to tackle a wide variety of engineering, administrative and legal tasks. In these middle years students are allowed to select a total of six modules from outside the geomatics programme, so as to equip each with skills relevant to the specific career he or she intends following.
- The fourth year focuses on management and professional skills and on preparation and presentation of individually chosen research projects.
- In the vacations most of our students work in the geomatics industry, acquiring practical skills and acquainting themselves with opportunities and personalities that will help them after graduation.

Some of the modules offered for the geomatics degree are also useful for field scientists such as geologists and biologists. These courses include:

- Geomatics I and II,
- Remote Sensing,
- Geographic Information Systems,
- Land Information Management,
- Hydrographic surveying, and
- Photogrammetry.

MECHANICAL ENGINEERING

Mechanical Engineering is broad-based, covering areas such as machine design, materials engineering, aerodynamics, power generation, mechatronics, and dynamics to name a few. Many of the fields of Mechanical Engineering come together when exciting projects are undertaken, like producing a winning Formula 1Ferrari or designing a hypersonic passenger spacecraft.

The Mechanical Engineer

- A mechanical engineer is someone with a natural curiosity and a creative desire to make things that work.
- Mechanical engineers combine sound knowledge of physical and engineering science with ingenuity to create the mechanical devices and systems that are essential to almost every industry and every phase of technology.
- Their activities range from those leading to the production of a machine (research, design, development and manufacturing) to those ensuring the optimal performance of the equipment (manufacturing and production), including management and consultation.

Career Opportunities for the Mechanical Engineer

- A wide variety of career opportunities are available to mechanical engineers in diverse areas such as transportation; nuclear, solar and fossil fuel energy development and utilisation; mining and earth moving equipment; heating and air-conditioning; air and water pollution control; metals and materials; or in the development of orthopaedic apparatus.
- Research forms an integral part of the development of many of these areas to establish and develop operating principles of mechanisms, devices and systems.
- Many mechanical engineers find careers in manufacturing industries. In the automotive industry, for example, they are involved in the design, development, fabrication, assembly and maintenance of engines, transmissions, chassis, bodies and suspension systems.
- Indeed the mechanical engineer forms a vital and integral part in the maintenance and management of systems in nearly all types of industry; whether they involve space technologies, computerised industrial systems or the extension of conventional technology to undeveloped areas.

The Bachelor of Science in Engineering Degree (BScEng)

The degree of Bachelor of Science in Engineering in the field of Mechanical Engineering is an Honours equivalent, professional Bachelors degree that extends over four years. Instruction is through lectures, tutorials and laboratory practicals. Extensive use is made of computers in well-equipped facilities.

A student is expected to be capable of accurate and analytical thought, and to possess motivation, creativity and technical aptitude. And with ability in Mathematics and Science at school, this suggests that a rewarding career in Mechanical Engineering should be considered. The Mechanical Engineering programme is designed to give the student a solid foundation in the basic subjects as well as specific preparation for his or her future work as a Mechanical Engineer.

PROPERTY DEVELOPMENT, CONSTRUCTION MANAGEMENT AND QUANTITY SURVEYING

History

- The Bachelor of Science in Property Development (BScPropDev) was introduced at UKZN as a three-year degree approximately 10 years ago. The BSc is then followed by a one-year Honours qualification in either Construction Management or Quantity Surveying.
- Two four-year professional qualifications: the BScQS (Quantity Surveying) and the BScCM (Construction Management) were offered previously. However, because the two professions require the same foundation knowledge in Commercial Mathematics, Law, Accounting, and the technical aspects of Construction, Property and Project Management, the degrees were restructured.
- The three-year BScPropDev provides sufficient knowledge to take up work in the property, construction and civil engineering project fields.
- The Honours degrees provide the professional specialisation to equip one to enter the working world in a more skilled position, with more of the requirements already met for the process of registration by one of the Councils (see below) as a professional construction project manager or quantity surveyor.
- In 2012/3, this area was identified as a scarce skill sector desperately needed for the economic growth of South Africa. As a result, professional and government agencies for the construction industry worked together to fund UKZN to reintroduce the degrees. Hence, in 2014, the 1st year of the original BScPropDev will again be offered on Howard College campus in the School of Engineering. The two Honours degrees, as discussed above, will follow.

General Overview of Careers in Construction Management and Quantity Surveying

There are excellent employment opportunities for both Construction Managers and Quantity Surveyors.

- Both Construction Management and Quantity Surveying at UKZN are professional qualifications which allow graduates to be accredited by the SA Council for the Quantity Surveying Profession (SACQSP) and The South African Council for Project and Construction Management Professions (SACPCMP).
- The two programmes overlap with the structures and construction side of Civil Engineering and with Architecture, as all of these professionals work as a team to ensure that building projects are safe, effective and efficient in terms of design, function, technology, human resources, law, and finances.
- Both Construction Managers and Quantity Surveyors are trained specialists in the technical business aspects of property and construction projects.
- Both Construction Managers and Quantity Surveyors need to be able to work at a senior management level, with legal contracts, architectural and engineering plans, and building specifications, and to be knowledgeable about construction methods, materials, and regulations.
- Both Construction Managers and Quantity Surveyors need to have the mathematical and accounting literacy to be able to work on computers with software programmes to undertake job costing, online collaboration, scheduling, and estimating. They also need excellent written and verbal communication skills.
- Construction Managers specialise in the technology management (technical construction aspects), and project management of construction,
- Quantity Surveyors specialise in the financial and legal management side of property and construction.

What is a Property or Real Estate Valuer?

Valuations are made for many different purposes, such as rating and taxing, finance, financial reporting, investment, insurance, rental, sale and purchase. A valuer therefore requires a good character and reputation, good communication skills, a reasonable ability in mathematics, sound judgment and good analytical skills.

A real estate valuer undertakes the following kinds of work:

- valuation of land and different types of properties, such as commercial, industrial, residential, rural, hotel, retail and other business properties, or plant and machinery,
- consulting with solicitors, surveyors, town planners, architects, accountants, property developers, owners and financiers to obtain the information required,
- analysing property investment returns, acting as expert witnesses to argue on behalf of people whose property has been acquired by an authority, working out appropriate rentals, and providing market valuations,
- writing reports: a valuer's competence is largely judged on the quality and thoroughness of these reports.

Becoming a Professional Engineer

The Engineering Council of South Africa (www.ecsa.co.za) accepts UKZN's BScEng qualification as being consistent with its requirements for undergraduate training. Graduates require a further three years of relevant work experience before they can qualify for registration as a Professional Engineer. ECSA is recognised for Professional registration by the Washington Accord countries, namely: South Africa, USA, Canada, Ireland, the UK, Australia, New Zealand and Hong Kong.

Contact Us

Further information can be obtained at the University of KwaZulu-Natal's Winter School and the University Open Day which embrace all branches of Engineering.

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