

Mechanical and Aeronautical Engineering

2013

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**Head: Department of Mechanical and
Aeronautical Engineering**



Engineering Tutorials

More about UP

- University: 44 000 + 22 000 students
- Confer >13 000 degrees per annum
- Eight Faculties
- Faculty of Engineering, Built Environment and Information Technology: >10 000 students
- School of Engineering: >7 000 students
- Department of Mechanical and Aeronautical Engineering: >1 400 students

Mechanical Engineering at UP

- High standards and international recognition. Largest engineering school in South Africa
- Quarter of country's engineers
- Degree accredited by Engineering Council of SA.
Degree recognised under the Washington Accord

Recognised in UK, Ireland, Canada, USA, New Zealand, Australia, Hong Kong, Taiwan, Japan, Korea, Malaysia, Russia and Singapore

Provisional status: Germany, India, Sri Lanka, Bangladesh and Pakistan

Mechanical Engineering at UP

- **International ISI ranking: Best engineering school in SA.**
- **Among the top 1% of the world. Collaboration with various universities, including:**

Massachusetts Institute of Technology (MIT), Swiss Federal Institute of Technology (Lausanne), Ghent University, Delft University, Padova University, University of Stuttgart, Lund University, University of Illinois at Urbana-Champaign (UIUC), Chalmers University of Technology, École Polytechnique de Montréal, Hogeschool Gent, Linköping University, Queen's University (Belfast), Queen's University (Ontario), Royal Institute of Technology, Singapore Polytechnic, Technical University of Denmark, US Naval Academy, University of Auckland, and the University of Liverpool

MIT Exchange



Elsmarie Wium (2013)



Herman Strauss (2013)



Carla Ubbink (2012)



Oscar Nouwens (2012)



Kearabetswe Mabe (2010)



Dale Lidston (2010)

Engineering Applications

- Applications opened on 1 March 2013
- Deadline: **30 September 2013 (1900 spaces)**
- Apply sooner than later
- We use Grade 11 marks and NBT for admission
- Website: www.up.ac.za
 - Apply online or application form

Engineering at Tukkies

Admission requirements for National Senior Certificate

- Admission Point Score (APS)
- APS=sum of 6 subjects
- APS (highest) = 42
- Life Orientation is excluded from APS
- Life orientation > 3

Achievement	Marks
7	80+
6	70-79
5	60-69
4	50-59
3	40-49
2	30-39
1	0-29

Engineering at Tukkies

Four year programme

Admission Requirements

Maths: 6

Physical Science: 6

English or Afrikaans: 5 (60-69%)

Automatic entry

APS \geq 35

National Benchmark Test

Five year programme (ENGAGE)

Admission Requirements

Maths: 5

Physical Science: 5

English or Afrikaans: 5 (60-69%)

Automatic entry

APS \geq 25

National Benchmark Test



Engineering at Tukkies

Individual entry is considered

Four year

Maths: 6

Physical science: 5

English/Afrikaans: 5

APS: 30

No Grade 12 marks below 5

Engineering at Tukkies

Individual entry is considered

Engage

One of following

Maths: 5

Maths: 5

Physical science: 4

Physical science: 5

English/Afrikaans: 4

English/Afrikaans: 5

APS: 25

APS: 25

National Benchmark Test

- NBT website: www.nbt.ac.za
- Two tests of three hours (English/Afrikaans):
 - Academic and Quantitative Literacy Test (AQL)
 - Mathematical (MAT)

20 Test dates beginning 25 May 2013

80 Venues (14 in Gauteng)

Results in 6 test codes: PU (proficient upper),
PL, IU, IL, BU, BL (basic lower)



What is ENGAGE?

- First two years spread over three years
- Maths plus additional maths
- Physics plus additional physics
- Material science plus additional material science
- Etc.
- Programme is very successful with high throughput (+80%)
- Pass rates in third/fourth years: 80-90%

Engineering at Tukkies

First year of Study

First semester

MGC110	Graphical Communication 111	16
WTW158	Calculus 158	16
FSK116	Physics 116	16
CHM171	General Chemistry 171	16
HAS101	Humanities and Social Sciences	8

Engineering at Tukkies

Fourth year of Study

Second semester

MSC400 Project 400	16
ETN420 Electrotechniques 420	16
MTV420 Thermal and Fluid Machines 420	16
COM420 Engineering Professionalism 420	8
MVE420 Vehicle Engineering 420	16
MLV420 Aeronautics 420	16
MME420 Maintenance Engineering 420	16
MKI420 Nuclear Engineering 420	16
MEC420 Mechatronics 420	16



Bioengineering?

Mechanical and Aeronautical Engineering

The application of maths and science to design, develop, manufacture and maintain mechanical equipment to meet the needs of society

Where do Mechanical Engineers Work?

- Private Industry
(BMW, Toyota, SAFAIR, Mining, Bosch, Kumba, Mittal)
- Government Services and Corporations
(SAA, Eskom, Telkom, etc.)
- Consulting Engineers
(LTA, G.H. Marais & Partners, C.A. du Toit & Partners, IST)
- Almost all sectors of economy: Chemical, Mining, Manufacturing, Process, Manufacturing, Cars/Vehicle, Defence, Aeronautical Industry, Corporate, Banking, Stock exchange
- Tertiary Education (University of Pretoria, etc.)
- Research (Universities, CSIR, WRC, etc.)
- Own Business (Entrepreneur)

Who Becomes a Mechanical Engineer?

- Comfortable with mathematics and science
- Practical ability
- Enjoy a challenge
- Creative ability
- Hard working
- Perseverance
- Organisational abilities and personal relationships

Engineering Team work

Rolls-Royce Deutschland: team of 2100 engineers from more than 30 nationalities: design, manufacturing and servicing of aerospace engines.

Women as Engineers?

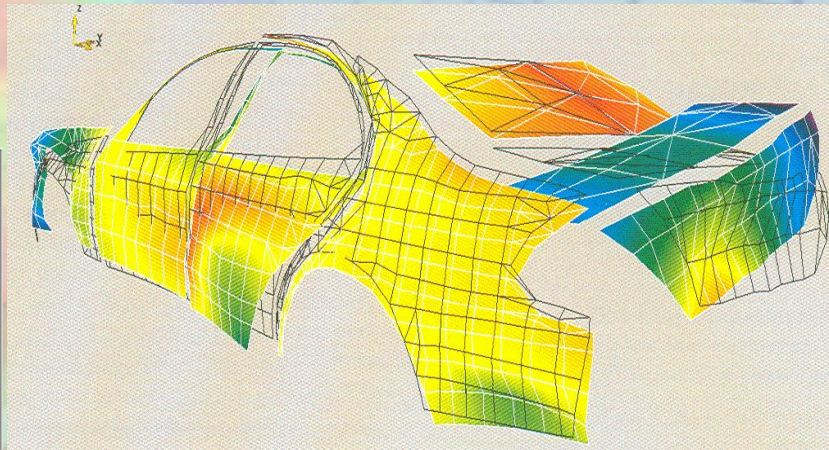
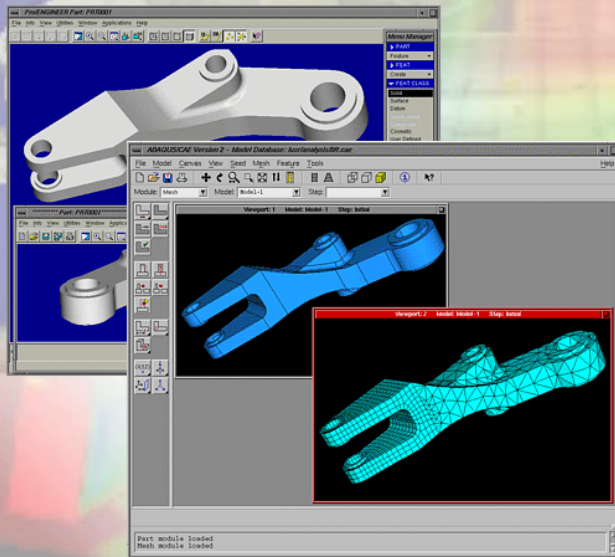
- Why not?
- You work with you brain not physical strength
- At present 20 to 40% are women
- Better communicators
- Better project leaders/managers
- Doing just as well and even better than men
- Some of our best students are women
- We want 50% (and more) of our students to be women

Disciplines in Mechanical Engineering

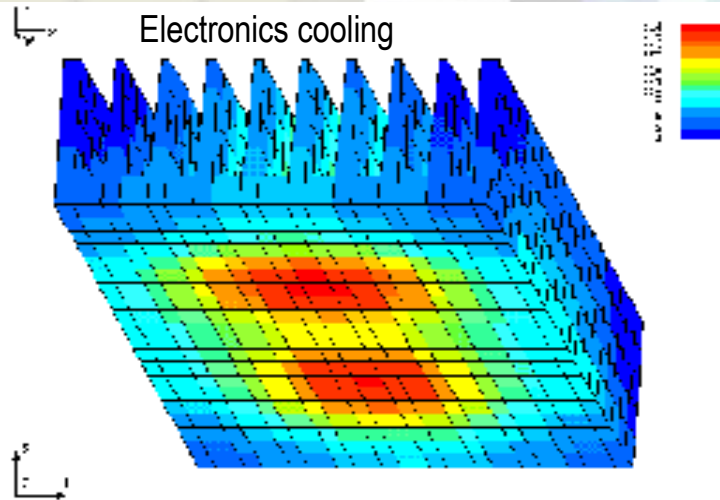
- Structural mechanics
- Thermodynamics
- Fluid mechanics
- Dynamics and control
- Design
- Aeronautics
- Maintenance Engineering
- Automotive Engineering
- Nuclear Engineering

Structural Mechanics

Structural mechanics deals with the analysis of the influence of forces on structures and includes the deformation and failure of mechanical structures. Simple as well as very sophisticated computer based finite element methods are used.

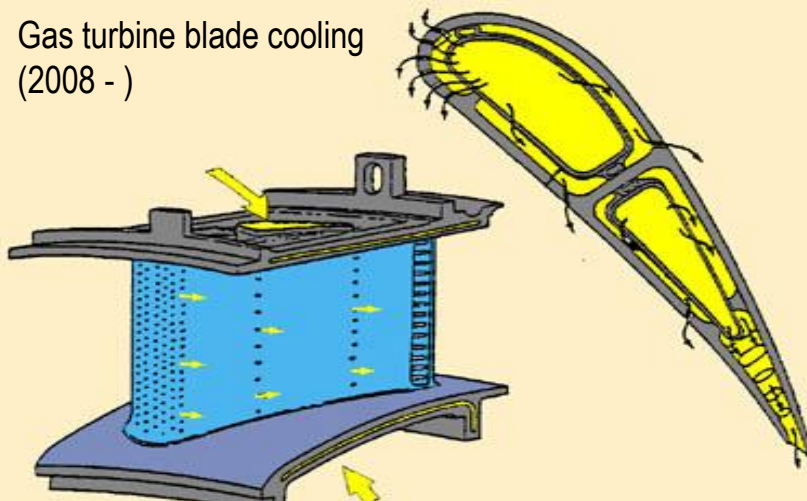


Engineering Thermodynamics



Thermodynamics is the study of energy, heat and work. It also deals with the conversion of energy from one form (e.g. coal) to another (e.g. heat, steam, electricity).

Gas turbine blade cooling
(2008 -)



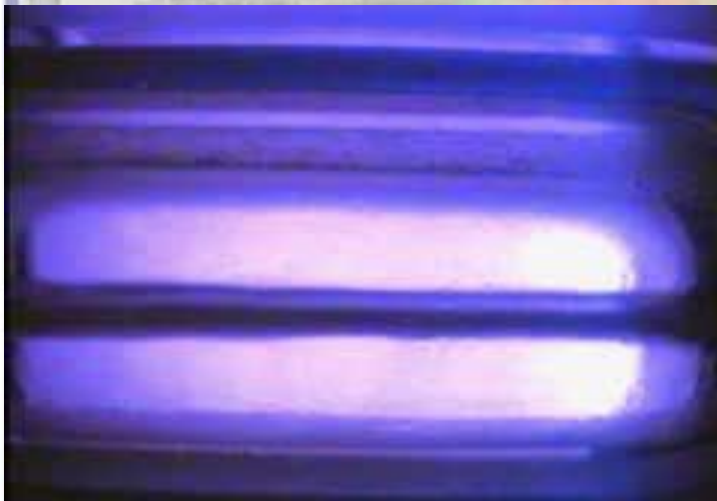
Air-cooled heat exchanger (2008 / 9)



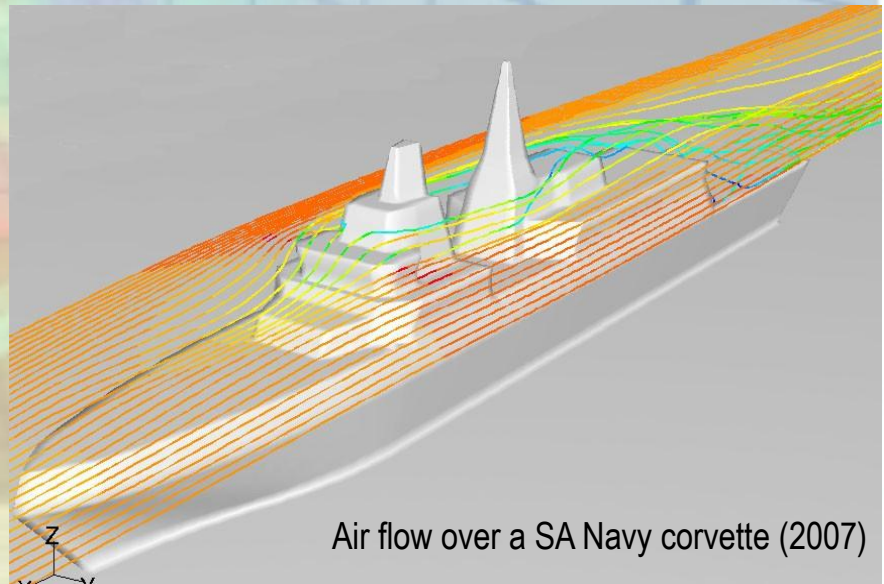
Engineering Fluid Mechanics

Fluid Mechanics

Fluid mechanics is applied wherever the behaviour of fluids is of engineering interest. Examples include flow over aircraft wings, vehicle aerodynamics, vehicle engine flow processes, building ventilation, flow boiling inside pipes, etc.



Refrigerant R-134a condensing inside a tube-in-tube heat exchanger (2008 -)



Air flow over a SA Navy corvette (2007)

Dynamics and Control

Dynamics deals with the motion of structures under the influence of forces. Where a particular dynamic response is desired, control algorithms may be employed to get the system response in accordance with what is desired.



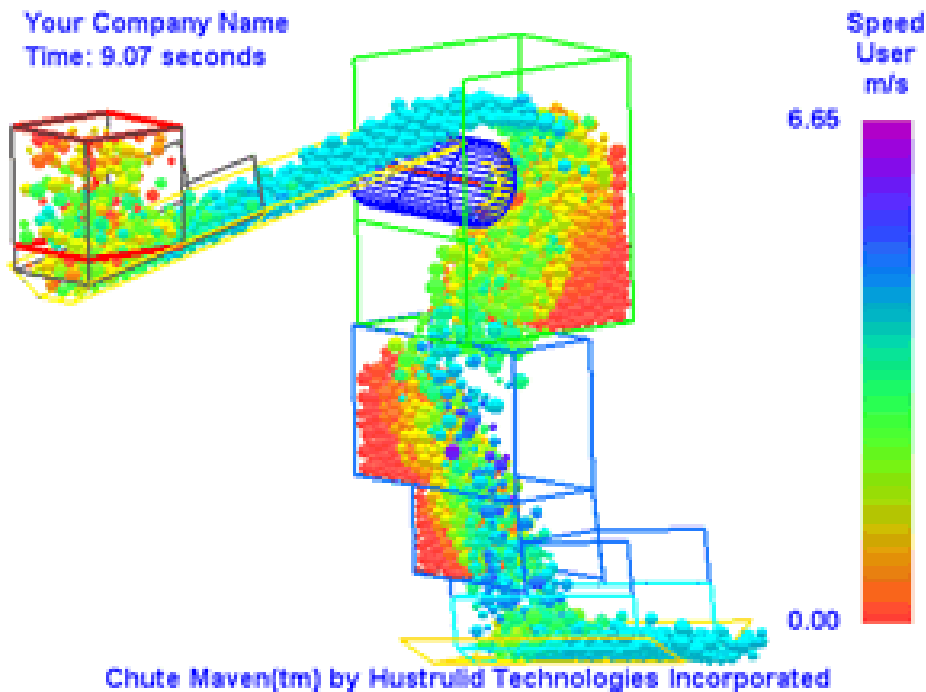
Conversion of Land Rover to fully-autonomous vehicle (2008/9)



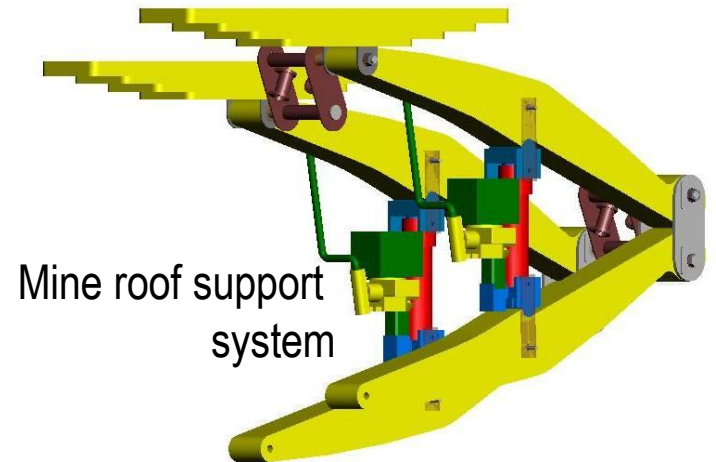
Dynamic road-load simulation

Design

Design is the activity that draws on the knowledge gained in the rest of the engineering disciplines with the aim to create new products, machines, technologies and services.

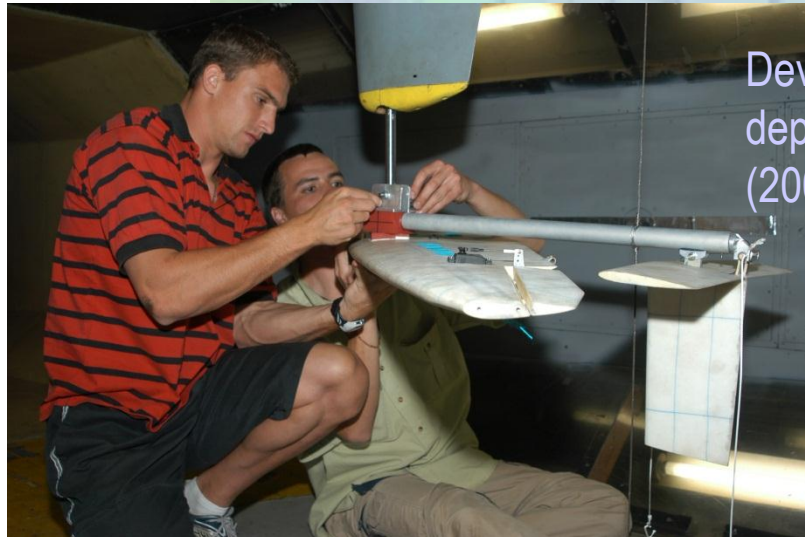
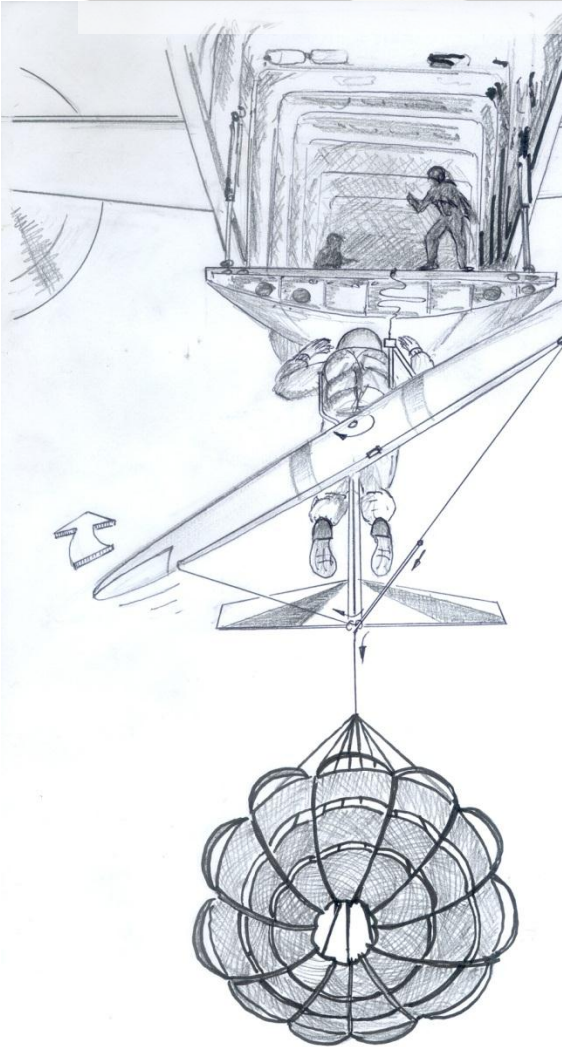


Chute design for open-cast mining operation



Aeronautical Engineering

The aeronautical engineer is able to predict the aerodynamic forces on bodies such as wings, rotor blades, car bodies, etc. He/she is involved in aerodynamics, airframe structures, aircraft propulsion and control during the development of aircraft.



Development of glider for deployment of special forces (2006)

Maintenance Engineering

Maintenance Engineering is the study of machines and systems with the purpose to increase the availability and reliability of these machines and or systems. It is also involved with the study of failure and how to best devise a corrective strategy if failure occurs.



Automotive Engineering

In Automotive Engineering, basic Mechanical Engineering principles are applied to design and improve cars, trucks and almost everything else that move on wheels.



Diesel research



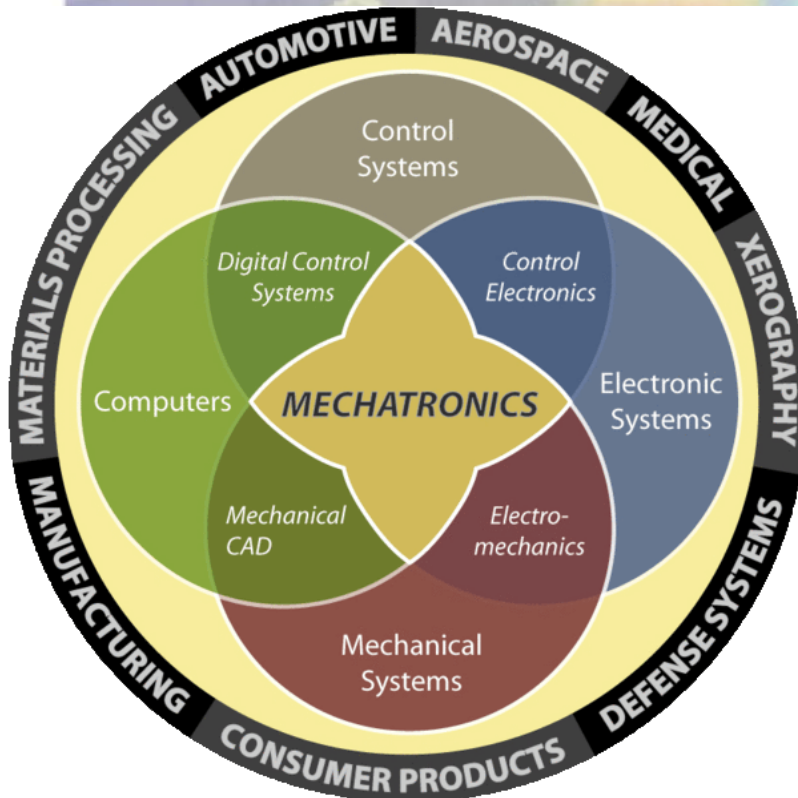
Computerised hydro-pneumatic suspension system (2007 -)



Special fluids cargo carrier (2004)

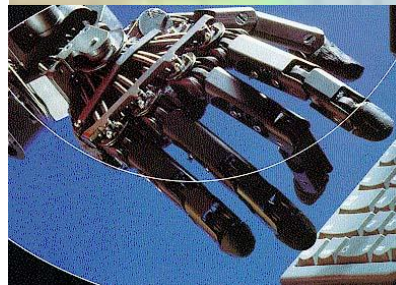
Mechatronics

Mechatronics is the combination of Mechanical engineering, Electronic engineering, Computer engineering, Control engineering, and Systems Design engineering in order to design, and manufacture useful products.



High technology
manufacturing using
robotics

Mining using robotics



LANGUAGE POLICY

1. Lectures in Afrikaans and English in first two years
2. English in third and fourth years
3. Industry (SA and internationally) operates in English
4. Recruit staff internationally
5. Engineering language (mathematics, sketches and drawings)
6. Accommodate Afrikaans and establish Afrikaans technical terminologies

Opportunities for mechanical & aeronautical engineers

- “Overwhelming demand for engineers”. Third of all positions advertised over the past 6 months were for engineers
- All industries (chemical, mining, manufacturing, motorcar, aeronautics, defence, banking, stock exchange, consulting, construction, etc.)
- Lots of advertisements for local talent from various countries: Saudi Arabia, Australia, New Zealand, Canada, etc.
- Companies: Rolls-Royce, Airbus, Boeing, NASA, ..

Magnitude of Scarcity

Chemical and Materials	590
Civil	2 940
Electrical	2 485
Electronics	925
Mechanical	12 665 (600/annum) = 21yr
Mining	295
Miscellaneous	185

Did you know?

Recent survey of 400 TUKS graduates:

- 85.4% employed
- 12.6% postgraduate studies
- **5 “without” jobs:**
 - 1 abroad
 - 3 just started looking for a job
 - 1 gap year

More information?

1. Brochures
2. Exhibitions of Denel Aerospace (UAVs, aircraft and missiles; designed by Tukkies graduates).
3. Engineering school:
 - 7 – 10 July 2013
4. Linda du Preez
 - 420 4937
5. <http://www.me.up.ac.za>
6. Client Service Centre <http://www.up.ac.za>
7. Application form:
<http://web.up.ac.za/default.asp?ipkCategoryID=44>
8. Video:
<http://www.youtube.com/watch?v=3hw4SMLhmlA&feature=youtu.be>

Engineering at UP

Artist rendering of the new School of Engineering building, which will feature extensive teaching and laboratory space, and a 1000-car parkade. (July 2011)



