Mechanical and Aeronautical Engineering

2017

Prof JP Meyer

Head: Department of Mechanical and Aeronautical Engineering

University of Pretoria

More about UP

- University: >55 000 students
- Confer >13 000 degrees per annum
- Eight Faculties
- Faculty of Engineering, Built Environment and Information Technology: >11 000 students
- School of Engineering: >7 000 students
- Department of Mechanical and Aeronautical Engineering: >1 900 students

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Class of 1959

Class of 2016

Mechanical Engineering at UP

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

  Recognised in South Africa, 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

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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

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MIT EXCHANGE

Leopold Beuken (2017)

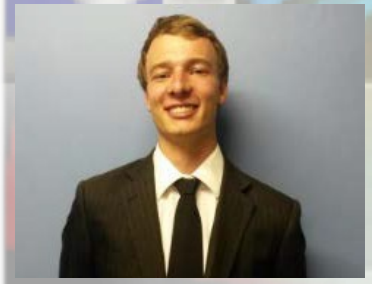
Jan-Dirk Heyns (2017)

Adrian McGlade (2017)

Nhlamulo Mutileni (2016)

Timothy Denton (2016)

Roberto Campanario (2016)



Martin Rencken (2015)

Christian Parschau (2015)

Alex Bernt (2015)

Johan Kotze (2015)

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MIT Exchange

Raymond Jansen (2014)

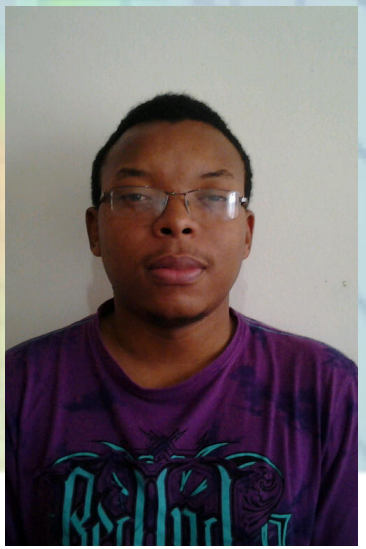
Jean-Pierre Theron (2014)

Elsmarie Wium (2013)

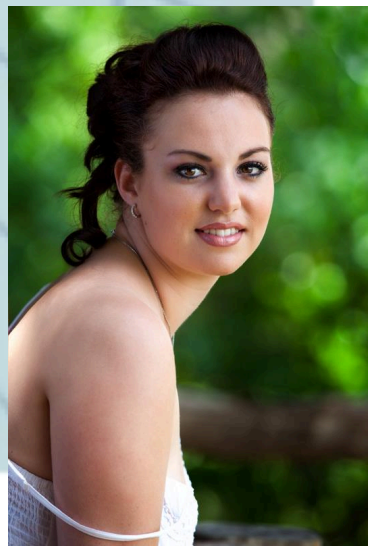
Herman Strauss (2013)

Carla Ubbink (2012)

Oscar Nouwens (2012)



Kearabetswe Mabe (2010)



Dale Lidston (2010)

Applications

- Applications opened on 1 March 2017
- Deadline: 30 September 2017
- Apply sooner than later
- We use Final Grade 11 marks and NBT for admission
- Website: www.up.ac.za/admissioninfo
  - Apply online or application form

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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

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Engineering at Tukkies

Four year programme

Admission Requirements

Maths: 6

Physical Science: 6

English or Afrikaans: 5 (60-69%)

Automatic entry

APS ≥ 35

National Benchmark Test (advice)

Five year programme (ENGAGE)

Admission Requirements

Maths: 5

Physical Science: 4

English or Afrikaans: 5 (60-69%)

Consider

APS ≥ 25

National Benchmark Test (compulsory)

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National Benchmark Test

- NBT website: www.nbt.ac.za
- Two tests of three hours (English/Afrikaans):
  - Academic and Quantitative Literacy Test (AQL)
  - Mathematical (MATH)
  - Visit www.nbt.ac.za for dates and more information on venues (not available yet)

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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%

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Engineering at Tukkies

First year of Study

First semester

MGC110	Graphical Communication	16
WTW158	Calculus	16
FSK116	Physics	16
CHM171	General Chemistry	16
HAS110	Humanities and Social Sciences	8
EBN 111	Electricity and Electronics	16

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Engineering at Tukkies

MRN 422 Research Project	24
MBB410 Control Systems	16
MTV420 Thermal and Fluid Machines	16
MVE420 Vehicle Engineering	16
MLV420 Aeronautics	16
MII420 Maintenance Engineering	16
MKI420 Nuclear Engineering	16
MEG420 Mechatronics	16
MOO420 Optimum Design	16

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Mechanical and Aeronautical Engineering

Definition

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

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Who Becomes a Mechanical Engineer?

- Comfortable with mathematics and science
- Practical ability
- Enjoy a challenge
- Creative ability
- Hard working
- Perseverance
- Good organiser's

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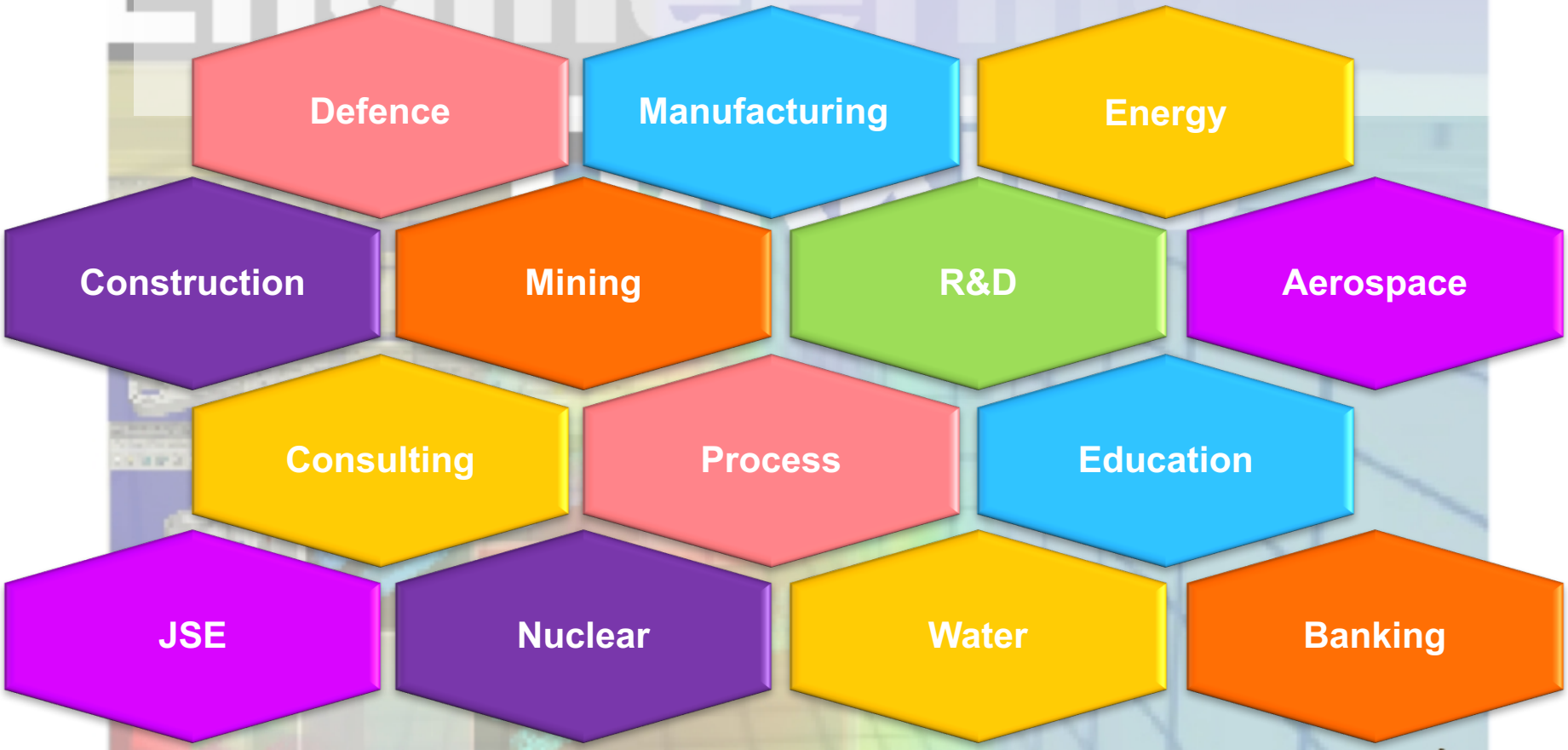
Where do our graduates work?



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Team work

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

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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

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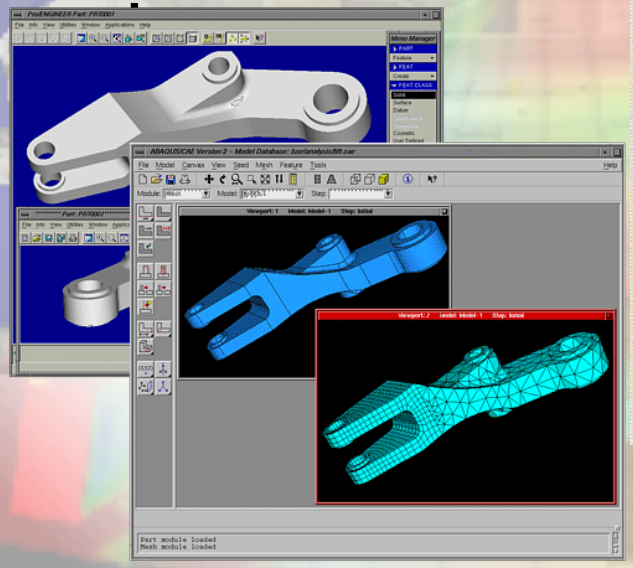
Disciplines in Mechanical Engineering

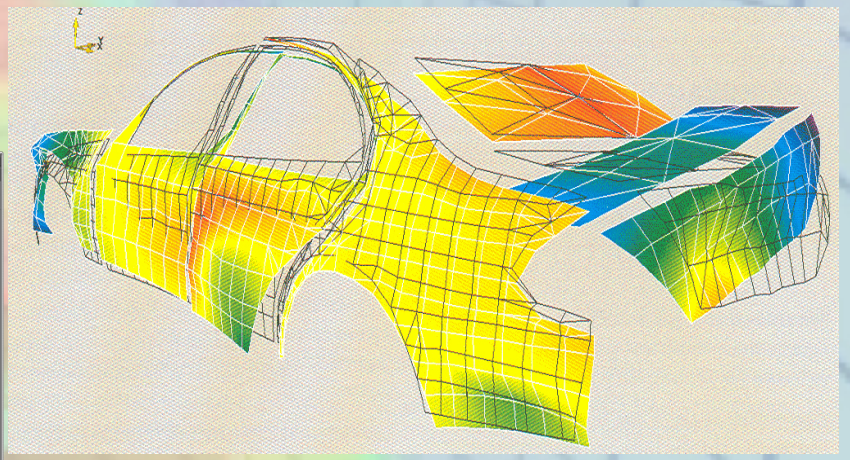
- Structural mechanics
- Thermodynamics
- Fluid mechanics
- Dynamics and control
- Design
- Aeronautics
- Mechatronics
- Bio engineering
- Maintenance Engineering
- Automotive Engineering
- Nuclear Engineering
- Renewable energy

Engineering Tukkies

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





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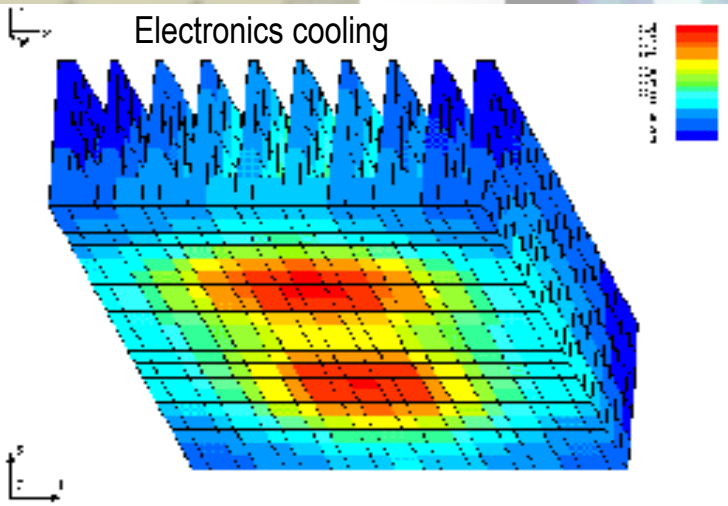
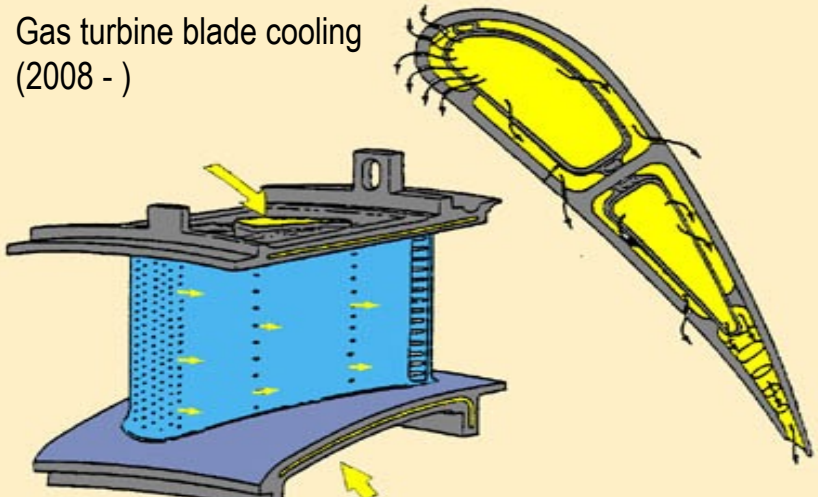
Thermodynamics

Electronics cooling



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).

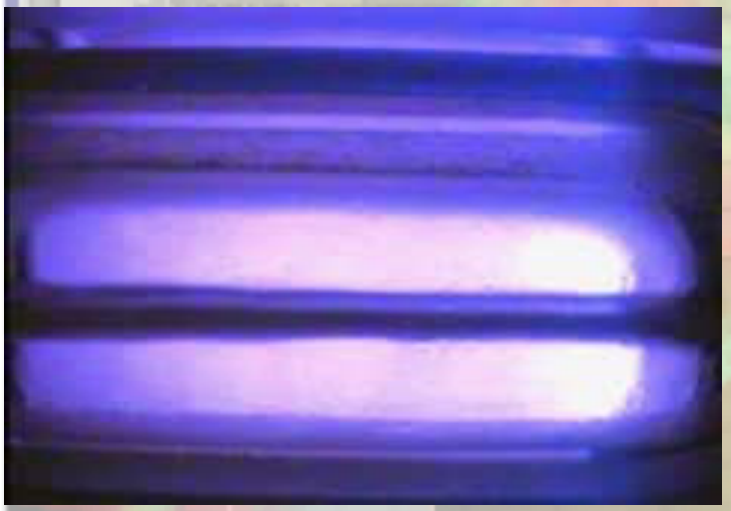
Gas turbine blade cooling (2008 -)



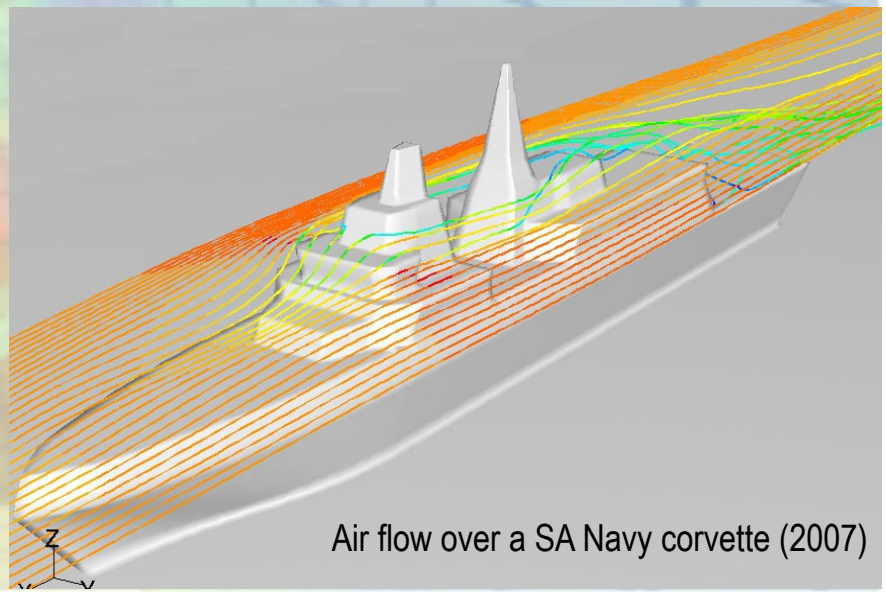
Air-cooled heat exchanger (2008 / 9)

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

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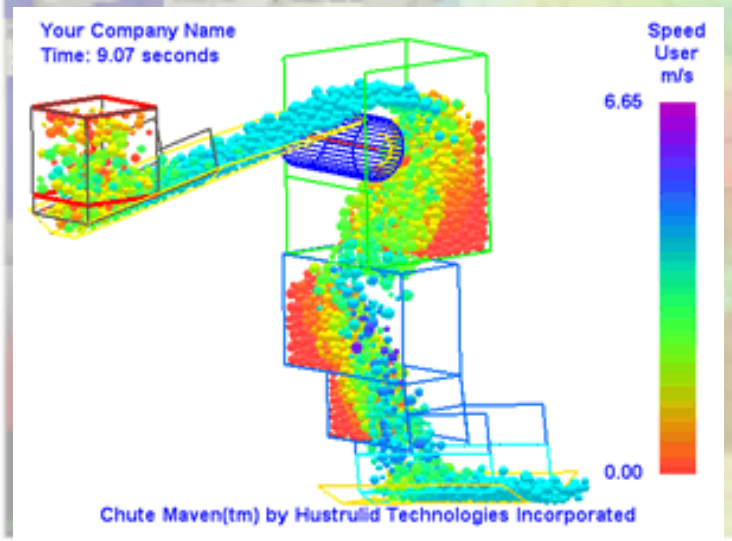
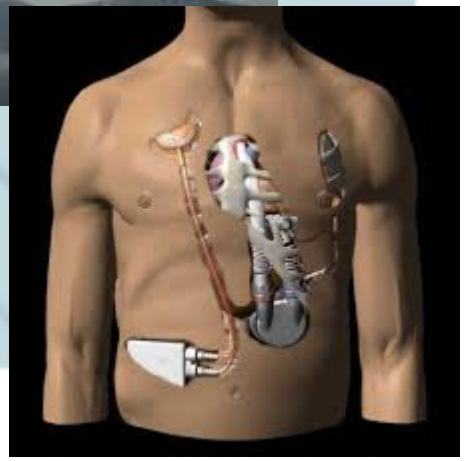
Design

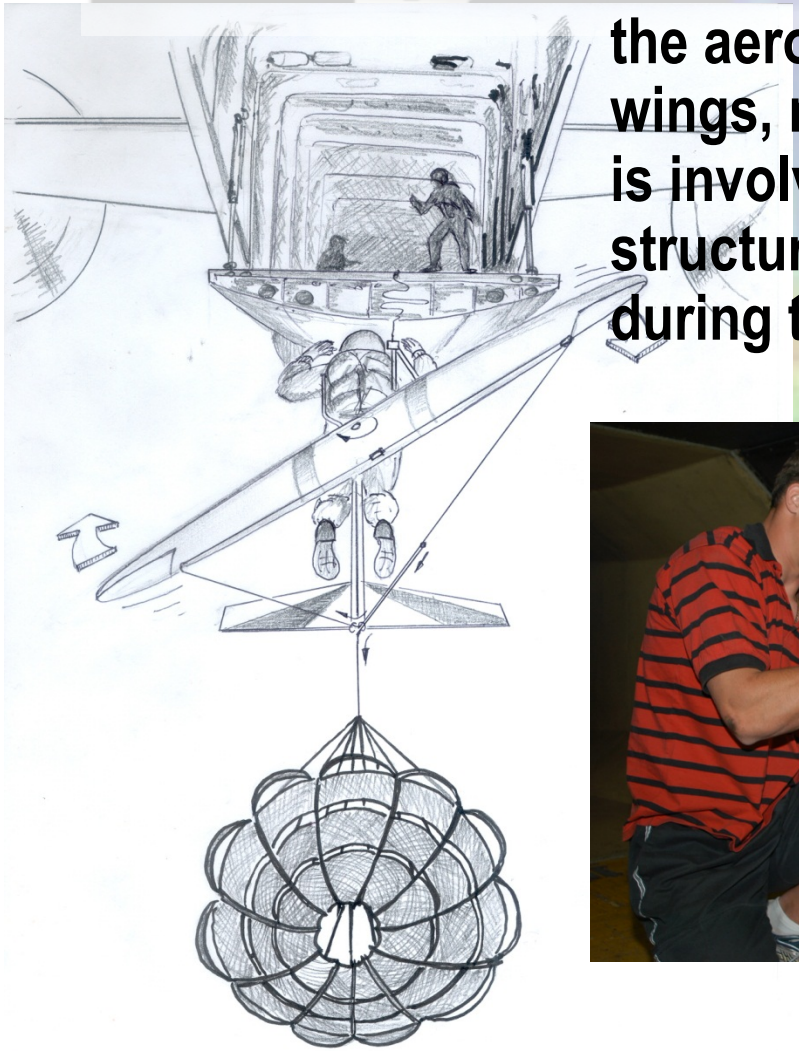
Design is the activity that draws on the knowledge gained in the rest of the engineering disciplines with the aim to create new products, machines, technologies and services.



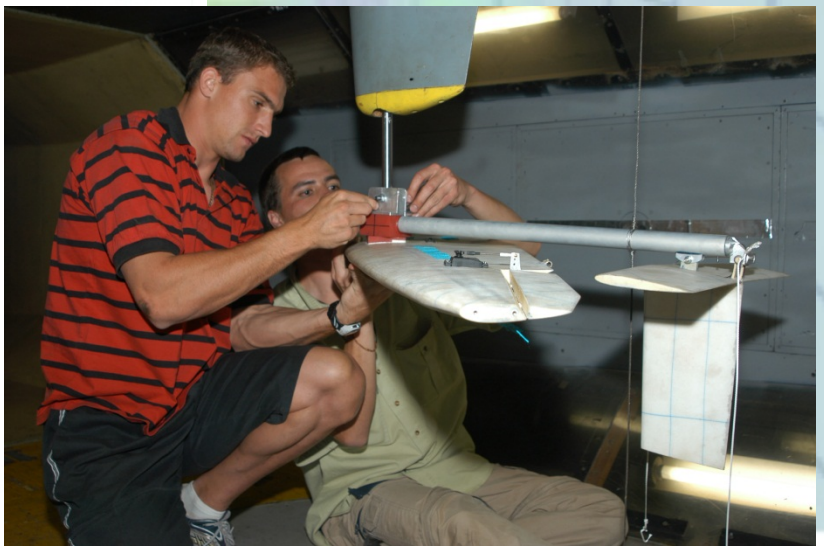


Chute design for open-cast mining operation

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)

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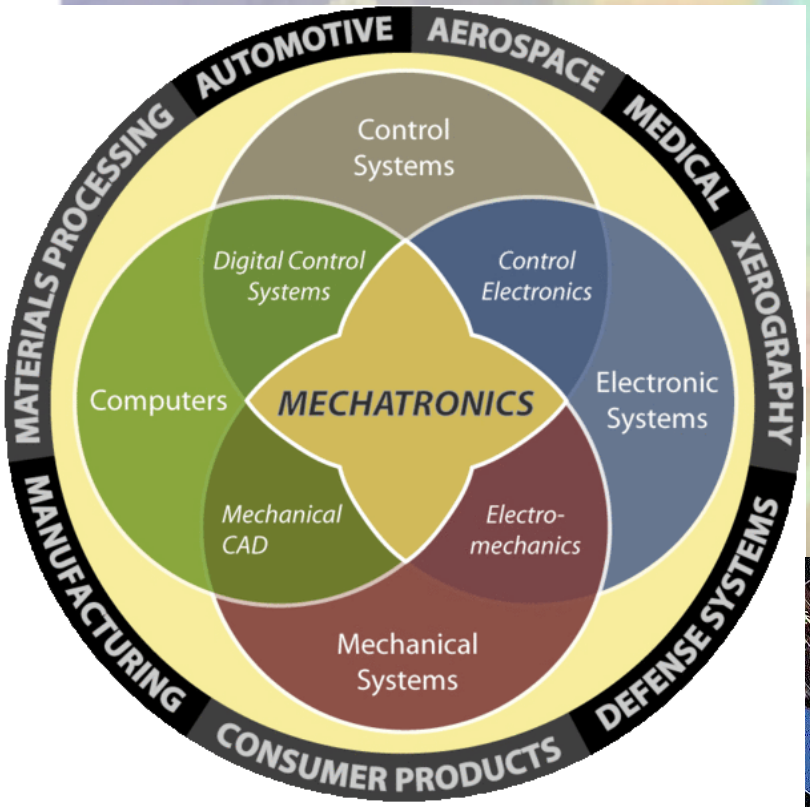
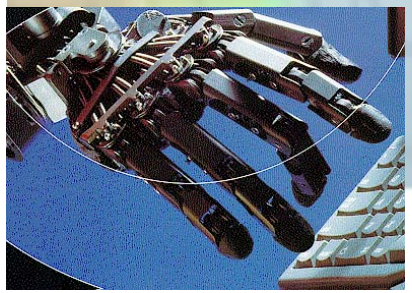
Mechatronics

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



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

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Magnitude of Scarcity

Chemical and Materials	590
Civil	2940
Electrical	2485
Electronics	925
Mechanical	12 665 (600 graduates/annum) = 21 yrs
Mining	295
Miscellaneous	185

Top 100 occupations

- Report by Department of Higher Education and Training (19 February 2014)
- Top 100 Occupations in High Demand in SA

1. Electrical Engineer	6. Finance Manager
2. Civil Engineer	7. Physical/Eng Science Technicians
3. Mechanical Engineer	8. Industrial & Production Eng
4. Quantity Surveyor	8. Electrician
5. Project Manager	10. Chemical Engineer

Based on national strategies, skill level, scarcity of qualified and experienced people, etc.

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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**

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More information?

1. Brochures
2. Exhibitions of Denel Aerospace (UAVs, aircraft and missiles; designed by Tukkie graduates).
3. Engineering Week:
   - 3 – 14 July 2017
4. Estie Powell
   - 012 420 4937
5. http//www.me.up.ac.za
6. Client Service Centre http://www.up.ac.za
7. Application form: http://www.up.ac.za/online-application

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