



# University of Pretoria

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Department of Electrical,  
Electronic & Computer Engineering



# Departmental video





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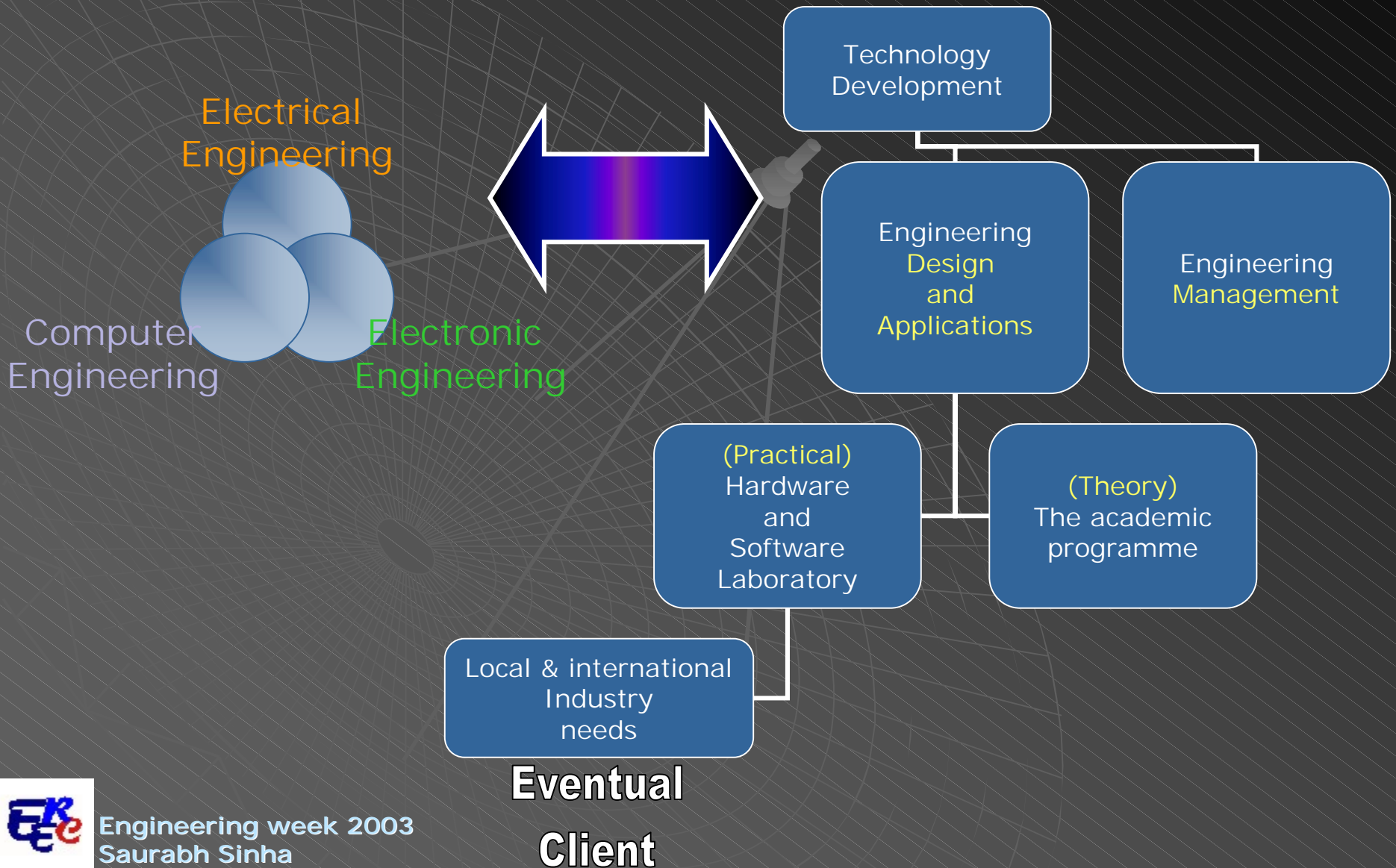
An overview

**Saurabh Sinha**



- Technology devt.
- History
- Situation on campus
- Faculty. ↔ Dept.
- Prospective students: General Admin.
- Undergraduate degrees
  - ◆ Electrical Engineering (E)
  - ◆ Electronic Engineering (Z)
  - ◆ Computer Engineering (R)
- *Common applications*
  - “Systems” diagram
    - ◆ “Teaching thinking”
  - Work content, environment and examples:
    - ◆ Electrical (E) & Electronic (Z) Engineers
    - ◆ Computer Engineers
  - Lifelong learning
    - ◆ Fields of specialisation (postgraduate)
  - Qualified Engineer & degree recognition
  - Technikon vs. University
  - Questions & contact details
  - Student life

# Technology Development



# History



Transvaal Universiteitskollege ("TUKs")  
Transvaal University College

[10 February 1908]

[Students: 32]



University of Pretoria

[10 October 1930]

[Students: 1074]

Today: ~ 33000 students  
(Largest residential Univ. in SA)

- Largest Dept. in South Africa
- ~ 700 Students
- ~ 45 Lecturers

Department of Electro-technical Engineering (1956)

Department of Electronic Engineering (1976)

→ 30 % of Engineers (South Africa)

- Highly competitive
- Research prog.
- Academic prog.

Department of Electronic and Electrical Engineering (1986)

Department of Electrical, Electronic & Computer Engineering **2000**



# Situation on campus



Engineering Tower  
(Eng. Bldg. 1)



Carl & Emily Fuchs  
Institute for Microelectronics  
(CEFIM)



(Eng. Bldg. 2)



One of 26 undergraduate labs

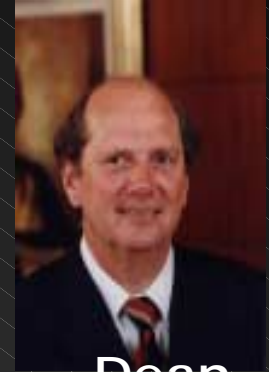


Compact Range  
(South Campus)

**Additionally:** Academic Info. Services (AIS) (Library)  
Study Centres (24 hours)  
Many others!

# Faculty ↔ Dept.

## Faculty of Engineering, Built Environment and Information Technology (IT)



Dean

Prof R F Sandenbergh

School of Engineering

School of IT

School of Engineering



Chairman of the School of Engineering  
Head of Dept.: Electrical, Electronic & Computer Eng.  
Prof F W Leuschner



# Prospective students: General Admin.

<p>No of years          ↓          Subjects (Matric)  <i>(In general)</i></p>	<p><u>Four</u>: (60 %: Mathematics HG)          (60 %: Phys. Sc. HG)</p> <p><u>Five</u>: (50 %: Mathematics HG)          (50 %: Phys. Sc. HG)</p> <div style="border: 1px solid black; background-color: #4a86e8; color: white; padding: 5px; text-align: center;">             Bridging prog.              Eg. DENEL         </div>
<p><b>Finances (2004)</b>  <b>(In general)</b></p> <p>Tuition: ~R 14000 p.a.          Books: ~R 4000 p.a.          Acc.: ~R 15000 p.a.          TOTAL: ~R 33000 p.a.          (+ Computer: ~R 7000 p.a.)</p>	<p>Bursaries/loans <i>(Some limited to: SA Citizens only)</i></p> <ul style="list-style-type: none"> <li>◆ UP Merit Bursary (Matric &amp; at UP)</li> <li>◆ Science EXPO &amp; Olympiad (School)</li> <li>◆ Leadership &amp; sports (School &amp; at UP)</li> <li>◆ Industries</li> <li>◆ Part-time work: local &amp; abroad (IAESTE)</li> <li>◆ Study loans &amp; other options</li> </ul>
<p><b>Accommodation</b></p>	<ul style="list-style-type: none"> <li>◆ On campus (Residences) (Student life)</li> <li>◆ Nearby campus (Private Acc.) (Daily students)</li> </ul>
<p><b>Language</b></p>	<p>English &amp; Afrikaans (//) (where possible)</p>
<p><b>Closing date</b></p>	<p>30 Sept. 2003</p>

Virtual: <http://www.up.ac.za/study/undergrad.html>

Real: CSC (Client Services Centre) (Opp. Lynnwood Rd. Entrance)



# Undergraduate Degrees



Electrical  
Engineering

Common courses  
First two years

Computer  
Engineering

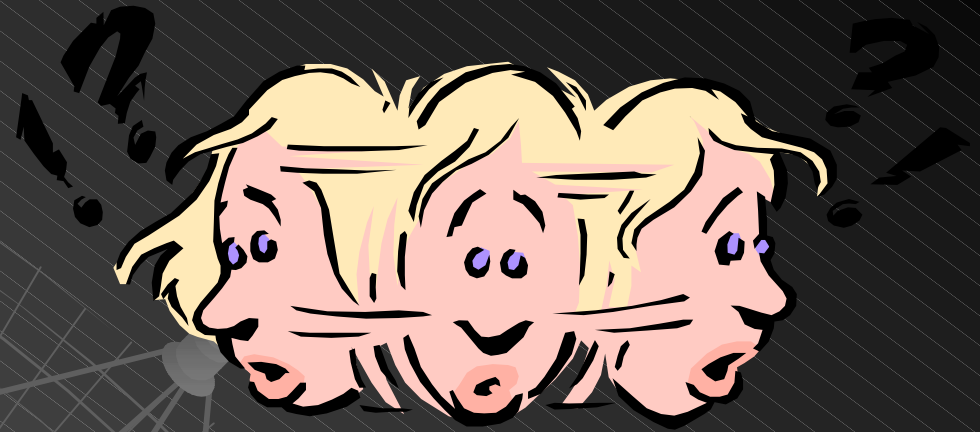
Electronic  
Engineering



Differs from  
first year



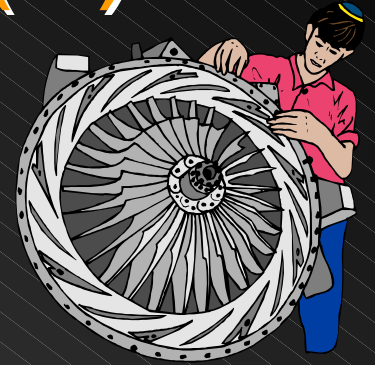
# Possibly?



- I want to do all three!
- I am interested in Electrical Engineering!
- Hmm..., definitely Computer Engineering!
- Hmm..., definitely Electronic Engineering!
- I am confused? ☹ Electronic or Computer Engineering?
- What happens if I make a wrong decision?
  - Change possibilities always remain!
  - Postgraduate specialisation

Please take note of our contact details if you have questions in future.

# Electrical Engineering (E)



- Energy conversion & management
- Electrical drives & propulsion
  - Control circuitry for motors
  - DC motors, induction motors, etc
- Industrial & power electronics
  - Power supplies, chargers & converters



Generation (Hydro/Thermal/Nuclear/Alternative)

Transmission (National grid)

Distribution, utilisation & control  
(Commercial & domestic usage)



Electrical  
Energy

# Electronic Engineering (Z1)

- ◆ Extension of human senses & capabilities with respect to information

Observation  
Sensors & transducers



Transformation



Filtering, amplification, modulation, transmission



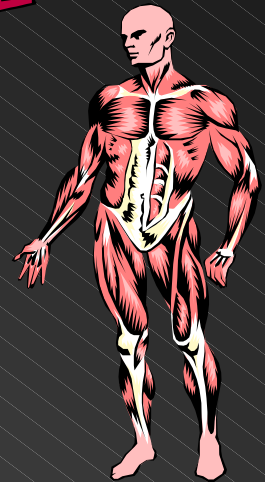
Utilisation

Processing, control, storage & presentation



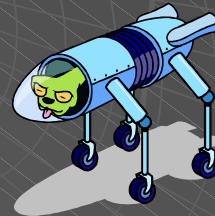
# Electronic Engineering (Z2)

- ◆ Transmission of information
  - Electromagnetic signal
  - Optical fibre
  - Infrared signal
  - Sound (audible, ultrasonic, sonar)
  - Wire (single, multi)
  - Magnetic
  - Etc



- ◆ Medium or channel of information

- Air
- Body (Source &/ medium) → Biomedical Engineering  
(Intro.: Cybernetics) (Undergrad)  
(Postgraduate)
- Control Engineering  
(Intro.: Cybernetics) (Undergrad)  
(Postgraduate)

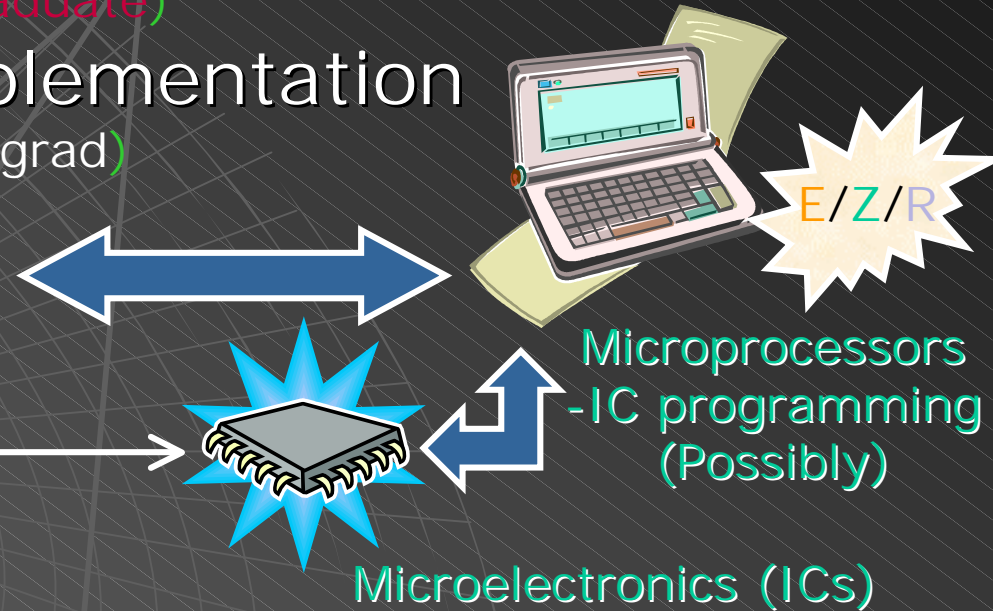


Robotics

# Electronic Engineering (Z3)

## ◆ Design implementation

- “Discrete” electronics (with possible software control) (Intro.: A few courses) (Undergrad) (Postgraduate)
- Microelectronics implementation (Intro.: A few courses) (Undergrad) (Postgraduate)

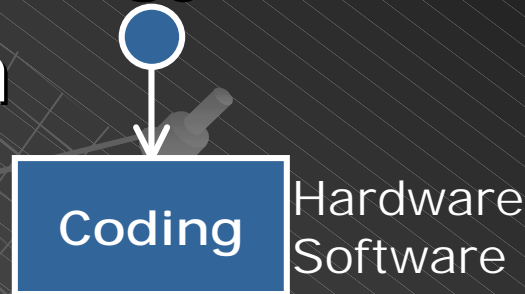
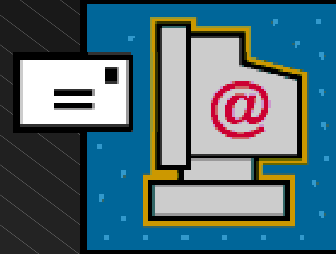


Electronics (Note: it is diverse)

(Biomedical, control, ICs, telecom., computer, mgmt)

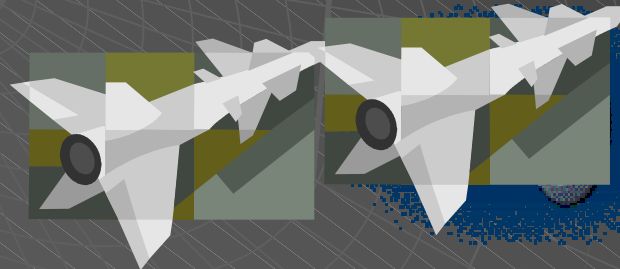
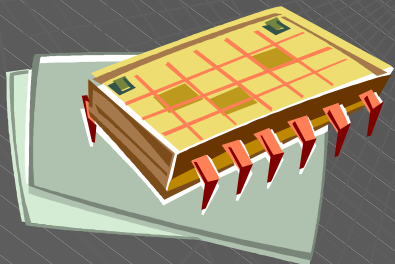
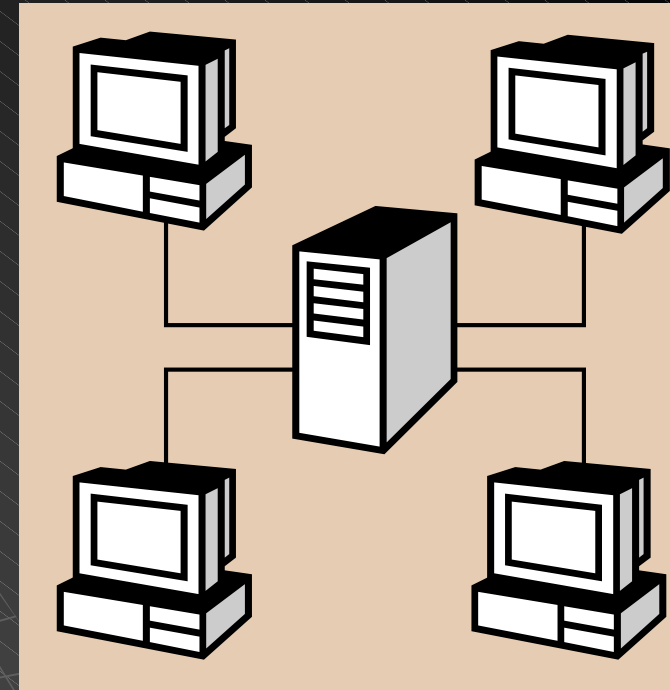
# Computer Engineering (R1)

- ◆ Information technology (IT) & ICT
- ◆ C: Communication

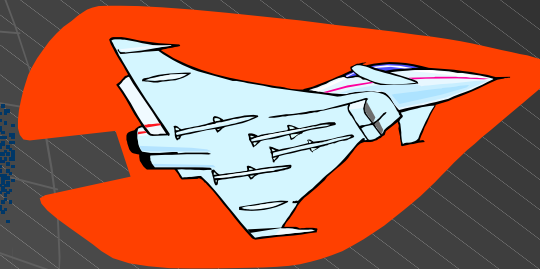


# Computer Engineering (R2)

- ◆ Hardware & software
  - Operating systems
    - ◆ Linux, Windows, etc
  - Network & network security
    - ◆ Protocols
      - (TCP/IP, FTP, ISDN, ATM, MPEG)
    - ◆ PC's, switches & routers
  - Artificial intelligence (AI) & Neural Networks
  - Embedded systems & controllers

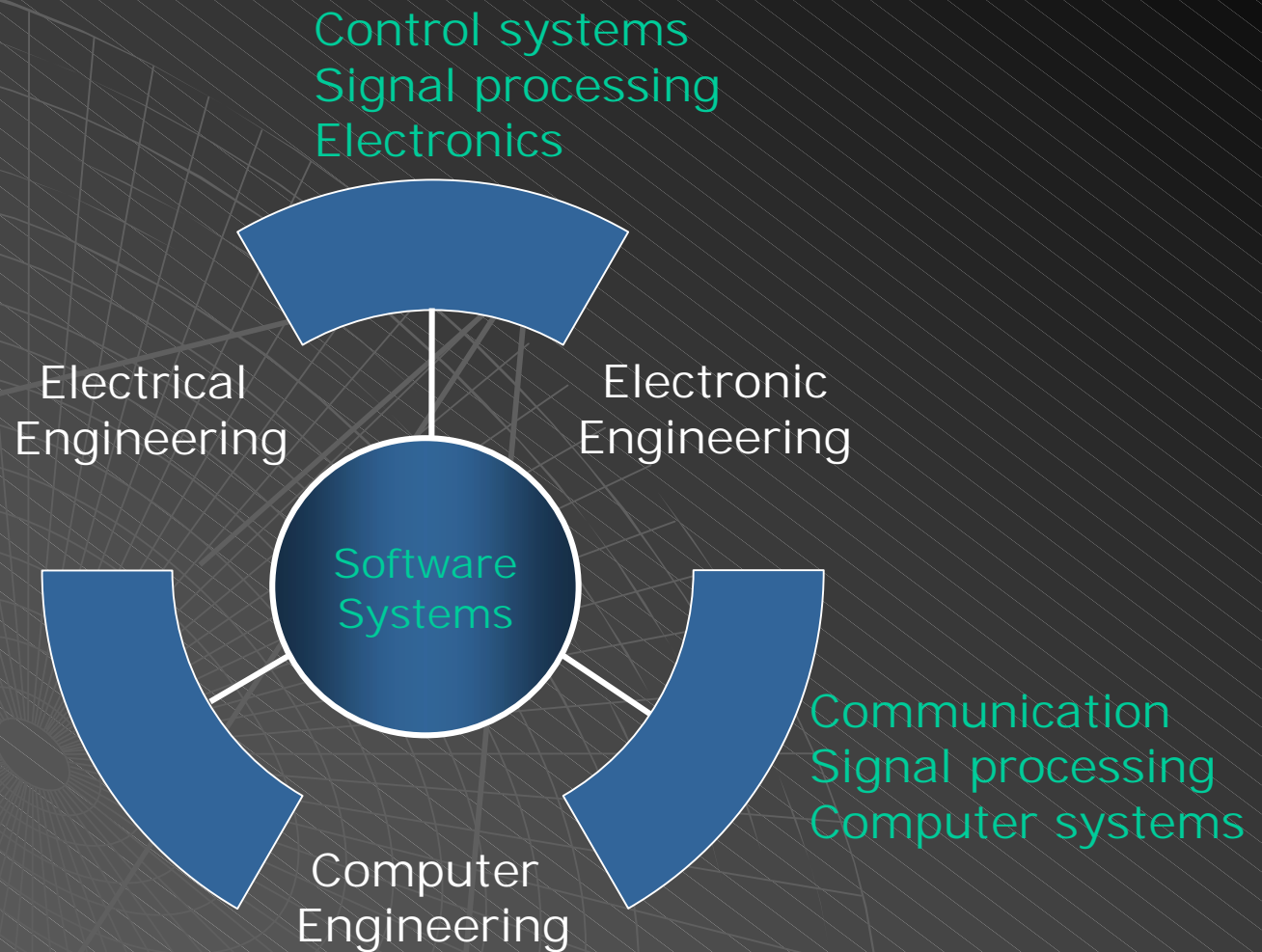


Fixed target



Moving target  
(e.g. UAV)

# Common applications



# Dilemma: Electronic or Computer?

- ◆ If you think you want to focus on understanding the software side of things, then you probably want to be a **computer scientist**. Typically, you'd be interested in algorithms, data structures, their implementation and their interaction with hardware, as well as their use in real world applications.
- ◆ If you think you will be comfortable with programming, but would also prefer to get your hands into the back of computer, or get to design something (devices, hardware, machines, and systems for real world applications) for a computer to connect to, or for a computer to control, or to make the next generation of hardware and computers, then you probably want to be a **computer engineer**.
- ◆ If you think you want to use a computer to do an engineering task, but you are more interested in the task that is being done than how the computer controls it, then you probably want to be an **electronic engineer**.

- Electrical or Electronic dilemma?
- Complete dilemma?!

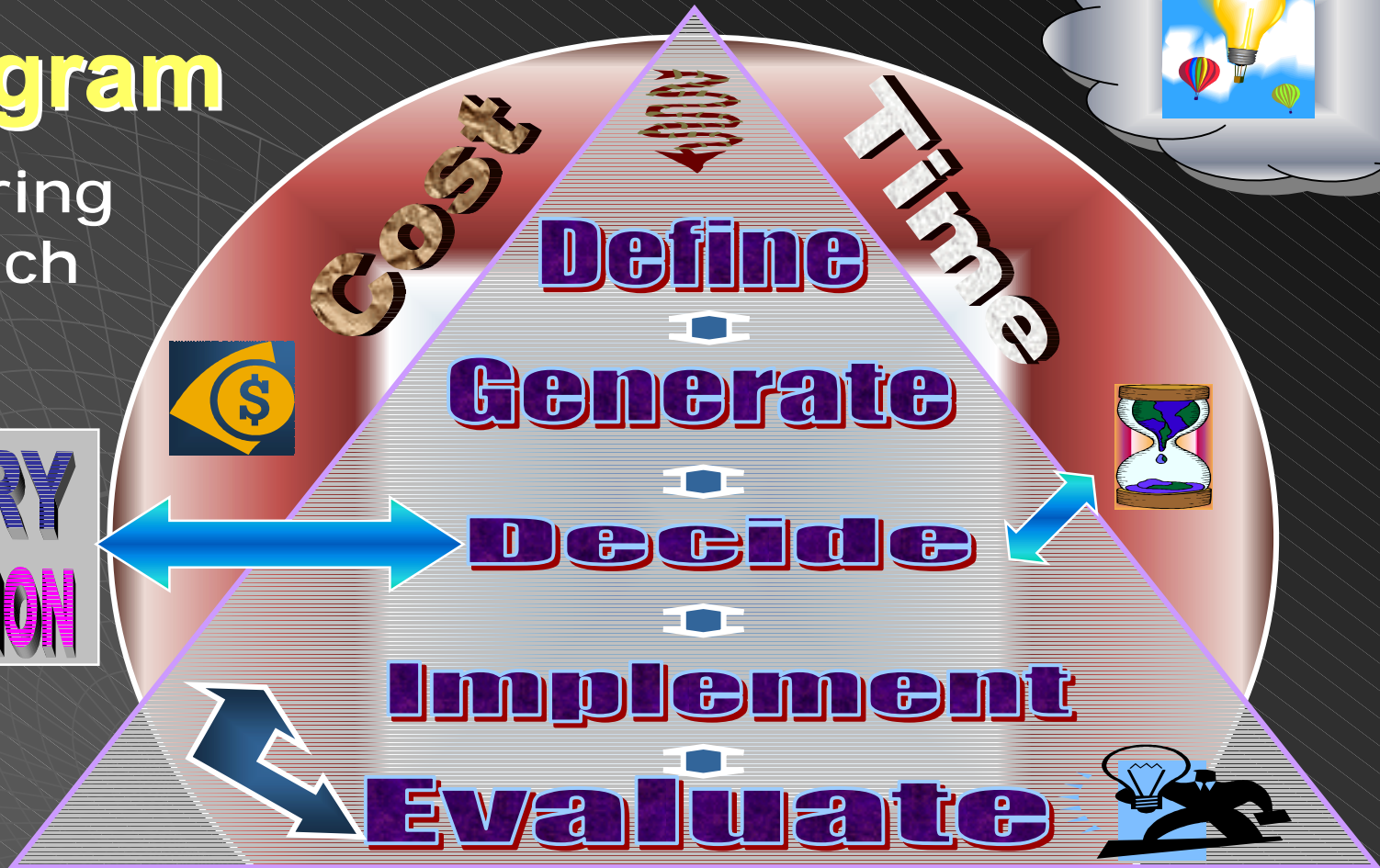


# "Systems" diagram



Engineering approach

**THEORY**  
**SIMULATION**



**Technical**  
**Performance**  
**Client**  
**relations**



# Teaching thinking

A student and his professor are backpacking in Alaska when a grizzly bear starts to chase them from a distance

The student replies:

"I don't need to outrun the bear;  
I only need to outrun you!"

Bottom line is...

True problems are often disguised!

*The Engineer needs to extract and solve the real problem from the "sea of information."*

# Work content of an Engineer

- ◆ Research & development
- ◆ Manufacturing and production
- ◆ Quality control, maintenance, support
- ◆ Marketing
- ◆ Engineering management
  - Project/general management
  - Product development management

# Work environment

- ◆ Predominantly technical environment
  - Laboratory, manufacturing, draughtsmen
- ◆ Multidisciplinary environment
  - Interactions with
    - ◆ Client & user
    - ◆ Marketing (& sales)
    - ◆ Financial management (buying office)
    - ◆ Legal practitioners (law of contracts)
    - ◆ "Human sciences"

# Where do E&Z Engineers work?

- ◆ Supply & distribution of electricity
- ◆ Industrial electronics & mining
- ◆ Development & manufacturing industry
  - Measuring instruments, computers, control systems
  - Military systems, communication systems
  - Medical support systems & prostheses
- ◆ Private consulting
  - Specialisation in the development & manufacturing of advanced technology

# Where do Comp. Eng. work?

- ◆ Specialist IT software design companies
  - Network design, network mgmt., protocol design, cryptography & communications security
- ◆ IT services
  - ISP's (Internet service providers)
  - Distributed databases (e.g. computicket, online shopping)
  - Web pages
  - E-commerce
  - Distance education
  - Video/voice on demand (e.g. video conferencing)

# Qualified Engineer

- ◆ Following requirements:
  - Matric (University Exemption)
  - University degree (**ECSA accredited**)
  - 3-year Engineer-in-training
    - ◆ ECSA (Candidate Engineer)
  - Professional Engineer
    - ◆ Pr Eng ... ECSA (Engineering Council of SA)
- ◆ Washington Accord & ECSA  
(International recognition)

# Lifelong learning

- ◆ **Academic** (Requirement: Undergraduate deg.)
  - B.Eng (Hons)
  - M.Eng
  - Ph.D. and/or D.Eng
- ◆ **Career enhancement**
  - Short courses (CE @ UP, and others)
  - Professional societies (IEEE, and others)
  - Personal & career (company) required research & study

# Fields of specialisation (postgrad)

- ◆ Bio-Engineering
- ◆ Radio & Digital communication
- ◆ Signals & telecommunication
- ◆ Measurements & control systems
- ◆ Industrial electronics & electrical drives
- ◆ Power systems engineering
- ◆ Electromagnetism
- ◆ Photonics
- ◆ Computer & pattern recognition
- ◆ Electronics & Microelectronics

Electrical Eng.  
Electronic Eng.

Undergraduate:

Students will have the opportunity in the Fourth/final year of study to work in/with one of the specialist research groups

# Fields of specialisation (postgrad)

Computer Eng.

- ◆ Pattern recognition
- ◆ Computer networks
- ◆ Software engineering
- ◆ Computer architecture & design
- ◆ Cryptography
- ◆ E-commerce

Undergraduate:

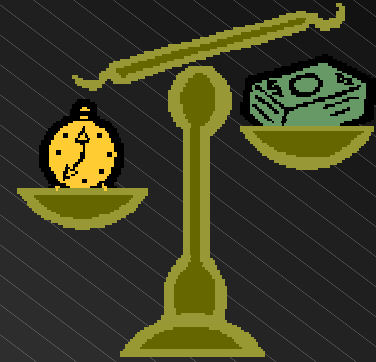
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# Technikon vs. University

- ◆ Technikon (Professional Technologist (ECSA))
  - "Know How"
  - Understanding existing technology
  - Application of existing technology
  - Implement designs
- ◆ University (Professional Engineer (ECSA))
  - "Know Why & How"
  - Education in underlying principles of technology to be able to solve problems
  - Be able to develop and adapt to new technology

# Student life

- ◆ Balanced life
  - Academic progression
  - Social progression
- ◆ Apply Engineering concepts in life!
  - Time management
  - Financial management
  - Personal management
  - Ethics management
  - "Relationship management"
  - Etc



# Questions/Answers

Contact:

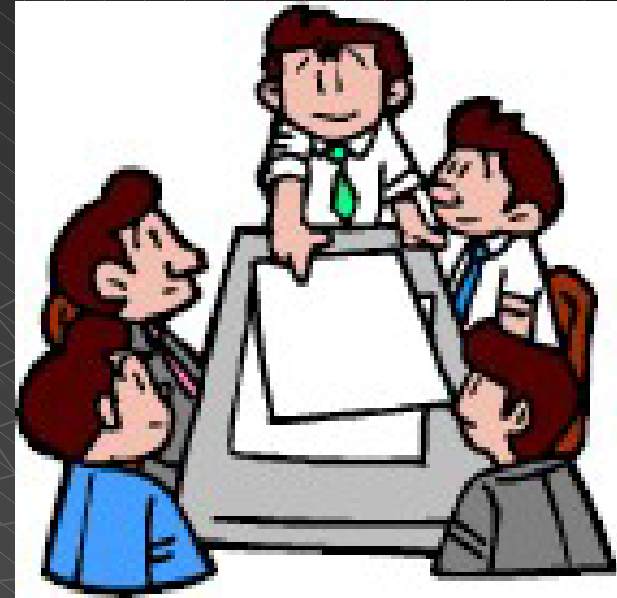


Saurabh Sinha

CEFIM: 2-11

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✉: [s.sinha@eng.up.ac.za](mailto:s.sinha@eng.up.ac.za)



➡ This presentation: <http://ieee.up.ac.za/~saurabhs/EWeek/EERC.ppt> (5.5 Mb)

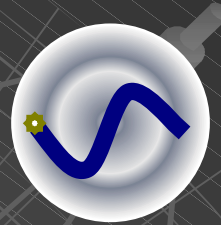
This presentation: <http://ieee.up.ac.za/~saurabhs/EWeek/EERC.pdf> (2 Mb)



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Computer Engineering



## FM Transmitter

**Saurabh Sinha**

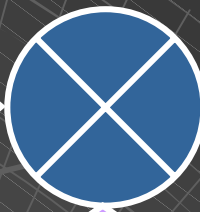


# Block diagram

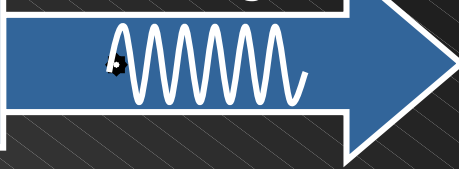
The radio station

Data

300-3000 Hz  
(voice)



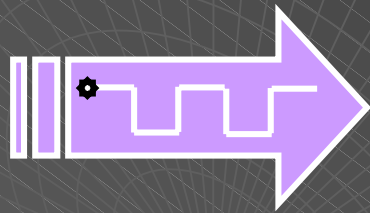
88-108 MHz  
(FM range)



Antenna

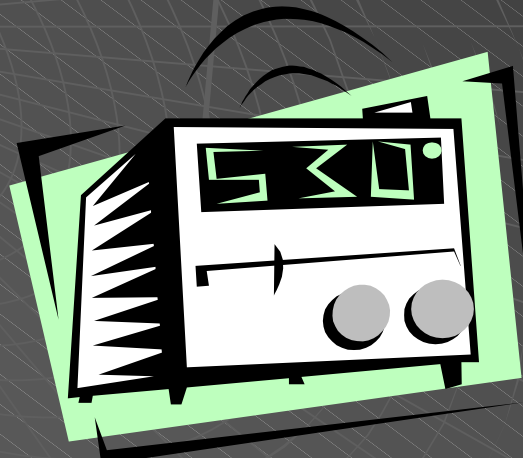
Tx (air)

User



Oscillator

FM Transmitter



"Tuning" to the radio station