

9 APPENDICES

APPENDIX A

COMPOSITION OF THE STUDY PANEL

Roelf Sandenbergh (Panel Chairperson)

Professor Roelf Sandenbergh obtained the degrees B. Eng. (Chemical) (1972), M. Eng. (Chemical) (1975) and D. Eng. (Metallurgical) (1983) from the University of Pretoria (UP). He began his career as Technical Assistant at the Hartebeestfontein Gold Mining Co. before joining UP in 1974, as Lecturer in the Department of Materials Science and Metallurgical Engineering. He became Head of the Department in 1996 and Chairman of the School of Engineering in 2001. He is the former Dean of the Faculty of Engineering, Built Environment and Information Technology at UP. He contributes to teaching, research and consulting in the fields of Extractive Metallurgy, Corrosion and Failure Analysis. Sandenbergh is a Registered Professional Engineer, Fellow of the South African Academy of Engineering, Member and Chairman of the Professional Advisory Committee on Metallurgical Engineering of the Engineering Council of South Africa (ECSA), Member of the Academy of Science of South Africa (ASSAf), Honorary Life Fellow of the South African Institute of Mining and Metallurgy, Member and previous President of the Corrosion Institute of Southern Africa.

Tshilidzi Marwala (Former Chairperson)

Professor Tshilidzi Marwala is Deputy Vice-Chancellor: Research at the University of Johannesburg (UJ). He was Executive Dean of the Faculty of Engineering and Built Environment at UJ. He also serves on the boards of City Power Johannesburg and EOH (Pty) Ltd). He is the youngest recipient of the Order of Mapungubwe and was the first African engineer to be awarded the President's Award by the National Research Foundation (NRF) of South Africa.

Tania Douglas

Professor Tania Douglas is Professor of Biomedical Engineering and Deputy Dean for Research in the Faculty of Health Sciences at the University of Cape Town (UCT). She is the Director of the Medical Research Council (MRC)/UCT Medical Imaging Research Unit and a Fellow of the South African Academy of Engineering (SAAE).

Bea Lacquet

Professor Bea Lacquet is the Deputy Vice-Chancellor: Information, Knowledge and Infrastructure Management at University of the Witwatersrand (Wits) and she was the Dean of the Faculty of Engineering and the Built Environment. She joined Wits in 2003 as De Beers Professor of Electronics in the School of Electrical and Information Engineering. She has authored and co-authored more than 150 journal papers and conference contributions. She jointly holds a few patents. She is an active Fellow of the South African Institute of Electrical Engineering (SAIEE) and serves on its council and various committees. She was the President of the SAIEE for the term 2005/06. She is a registered Professional Engineer and is actively serving on ECSA and the executive, and various committees of the council. She is also a senior member of the Institute of Electrical and Electronic Engineers (IEEE).

Deresh Ramjugernath

Professor Deresh Ramjugernath is a Professor of Chemical Engineering at the University of KwaZulu-Natal (UKZN). He is Director of the Thermodynamics Research Unit and also the holder of the Department of Science and Technology (DST)/NRF South African Research Chair in Fluorine Process Engineering and Separation Technology. Ramjugernath leads a large team of postgraduate students and researchers which undertakes research contributing towards understanding chemical process development and optimisation in the area of separation technology. The group actively contributes to the government's Fluorochemical Expansion Initiative (FEI) by researching and developing fluorinated products and chemical processes. The activities are integral to the development of a fluorochemical industry in the country.

Cristina Trois

Professor Cristina Trois is the Dean and Head of the School of Engineering at UKZN. She is a C2-rated scientist with the NRF and her main fields of expertise are: Environmental and Geo-Engineering, Waste Management, Wastewater Treatment, Renewable Energy from Waste and Greenhouse Gas Control from Zero Waste in Africa and developing countries. She is co-founder of the Centre for Research in Environmental, Coastal and Hydrological Engineering (CRECHE). She developed and has successfully coordinated the Masters Programme in Environmental Engineering since 2001. She has graduated 25 postgraduate students, and an average of eight to ten undergraduate students successfully complete their final-year dissertations under her supervision, every year.

Sue Harrison

Professor Sue Harrison is the Director of the Centre for Bioprocess Engineering Research and Deputy Dean of the Faculty of Engineering and the Built Environment at UCT. She has some 25 years' experience in research in bioprocess engineering, gained in the industrial and academic arenas. She worked as a research scientist in the research and development (R&D) department of AECI Ltd in Johannesburg for three years. In 1991, she joined the academic staff of the Department of Chemical Engineering at UCT. Her research in bioprocess engineering spans bacterial, fungal, archaeal and algal bioprocesses with application in biohydrometallurgy, AMD prevention, maximising resource productivity, bioenergy products, biocommodities from wastes, fine chemicals, nutraceuticals and expression of niche peptides and proteins. Through these she focuses on microbial dynamics, biokinetics, biological stress responses and process integration. She has a strong interest on quantifying environmental burden associated with processes with the view to its minimisation. Harrison has taught actively in the chemical engineering and biotechnology programmes at undergraduate and postgraduate levels at UCT and Cambridge. She served as Head of Department of Chemical Engineering from 1998 to 2002. She holds the South African DST Research Chair in Bioprocess. In the innovation space, she was a founding member and later Chair of the Board of the Cape Biotechnology Trust, and more recently is a board member of the Technology Innovation Agency (TIA).

APPENDIX B

POSTGRADUATE DEGREES AND DIPLOMAS OFFERED AT UNIVERSITIES WITH OR WITHOUT ENGINEERING FACULTIES AND UNIVERSITIES OF TECHNOLOGY

| UCT | | | | | | | | | | | | | | |
|---|-------------|--------|-----------|-----------|---|-------------|--------|-----------|----------------------|---------------------------------------|-------------|--------|-----------|-----------|
| Masters | | | | | PhD | | | | Postgraduate Diploma | | | | | |
| Course | Course-work | Thesis | Full time | Part time | Course | Course-work | Thesis | Full time | Part time | Course | Course-work | Thesis | Full time | Part time |
| Master of Geotechnical Engineering | | | | | Doctor of Science in Engineering | | | | | PG Diploma in Power Plant Engineering | x | | x | |
| Geotechnical Engineering | x | | | | Geomatics | x | | | | | | | | |
| | | | | | Chemical Engineering | x | | | | | | | | |
| Master of Engineering | | | | | Civil Engineering | x | | | | | | | | |
| Water Quality Engineering | x | | | | Electrical Engineering | x | | | | | | | | |
| Structural Engineering & Materials | x | | | | Mechanical Engineering | x | | | | | | | | |
| Transport Studies | x | | | | Materials Engineering | x | | | | | | | | |
| Civil Infrastructure Management and Maintenance | x | | | | | | | | | | | | | |
| Radar | x | | | | Doctor of Philosophy | | | | | | | | | |
| Nuclear Power | x | | | | Geomatics | x | | | | | | | | |
| Telecommunications | x | | | | Chemical Engineering | x | | | | | | | | |
| Minerals Beneficiation | x | | | | Engineering Education | x | | | | | | | | |
| | | | | | Civil Engineering | x | | | | | | | | |
| Master of Science in Engineering | | | | | Electrical Engineering | x | | | | | | | | |
| Geomatics | | | | | Mechanical Engineering | x | | | | | | | | |
| Chemical Engineering | | | | | Engineering Management | x | | | | | | | | |
| Civil Engineering | | | | | Materials Engineering | x | | | | | | | | |
| Electrical Engineering | | | | | | | | | | | | | | |
| Mechanical Engineering | | | | | | | | | | | | | | |
| Materials Engineering | | | | | | | | | | | | | | |

| UCT | | | | | | | | | | | | | |
|-----------------------------|---|---|--|--|--|--|--|--|--|--|--|--|--|
| Minerals | | | | | | | | | | | | | |
| Beneficiation | | | | | | | | | | | | | |
| Sustainable Energy | | | | | | | | | | | | | |
| Engineering | | | | | | | | | | | | | |
| Geotechnical | | | | | | | | | | | | | |
| Engineering | | | | | | | | | | | | | |
| Master of Philosophy | | | | | | | | | | | | | |
| Engineering | x | x | | | | | | | | | | | |
| Education | | | | | | | | | | | | | |
| Engineering | x | | | | | | | | | | | | |
| Management | | | | | | | | | | | | | |
| Electrical | x | x | | | | | | | | | | | |
| Engineering | | | | | | | | | | | | | |
| Civil Engineering | x | x | | | | | | | | | | | |

| UP | | | | | | | | | | | | | |
|--|-------------|--------|-----------|-----------|-------------------------------|-------------|--------|-----------|-----------|--|--|--|--|
| Masters | | | | | | | PhD | | | | | | |
| Course | Course-work | Thesis | Full time | Part time | Course | Course-work | Thesis | Full time | Part time | | | | |
| | | | | | | | | | | | | | |
| Master of Engineering | | | | | Doctor of Philosophy | | | | | | | | |
| MEng Bioengineering | x | x | x | | PhD Chemical Engineering | x | x | x | | | | | |
| MEng Chemical Engineering | x | x | x | | PhD Chemical Technology | x | x | x | | | | | |
| MEng Computer Engineering | | | x | x | PhD Civil | x | x | x | | | | | |
| MEng Control Engineering | x | x | x | | PhD Civil Engineering | x | x | x | | | | | |
| MEng Electrical Engineering | x | x | x | | PhD Computer Engineering | x | x | x | | | | | |
| MEng Electronic Engineering | x | x | x | | PhD Electrical | x | x | x | | | | | |
| MEng Engineering Management | x | | x | x | PhD Electrical Engineering | x | x | x | | | | | |
| MEng Environmental Engineering | x | x | x | | PhD Electronic Engineering | x | x | x | | | | | |
| MEng Geotechnical Engineering | x | x | x | | PhD Electronics | x | x | x | | | | | |
| MEng Industrial Engineering | x | x | x | | PhD Engineering Management | x | x | x | | | | | |
| MEng Mechanical Engineering | x | x | x | | PhD Industrial Engineering | x | x | x | | | | | |
| MEng Metallurgical Engineering | x | x | x | | PhD Industrial Systems | x | x | x | | | | | |
| MEng Microelectronic Engineering | x | x | x | | PhD Mechanical Engineering | x | x | x | | | | | |
| MEng Mining Engineering | x | x | x | | PhD Mechanics | x | x | x | | | | | |
| MEng Project Management | x | | x | x | PhD Metallurgical Engineering | x | x | x | | | | | |
| MEng Software Engineering | | | x | x | PhD Metallurgy | x | x | x | | | | | |
| MEng Structural Engineering | | | x | x | PhD Mining | x | x | x | | | | | |
| MEng Technology and Innovation Management | | | x | x | PhD Mining Engineering | x | x | x | | | | | |
| MEng Technology and Innovation Management (Coursework) | | | x | x | PhD (Biosystems) | x | x | x | | | | | |
| MEng Transportation Engineering | | | x | x | | | | | | | | | |
| MEng Water Resources Engineering | x | x | x | | | | | | | | | | |
| MEng Water Utilisation Engineering | x | x | x | | | | | | | | | | |

| UP | | | | | | | | | | |
|--|--|--|--|--|--|--|--|--|--|--|
| MSc (Applied Science) | | | | | | | | | | |
| MSc (App.Sci.) Chemical Technology | | | | | | | | | | |
| MSc (Appl.Sci.) (Environmental Technology) | | | | | | | | | | |
| MSc (Appl.Sci.) (Water Utilisation) | | | | | | | | | | |
| MSc (Appl.Sci.) Industrial systems | | | | | | | | | | |
| MSc (Appl.Sc) Control | | | | | | | | | | |
| MSc (Appl.Sc) EER | | | | | | | | | | |
| MSc (Appl.Sc) Mechanics | | | | | | | | | | |
| MSc (Appl.Sc) Metallurgy | | | | | | | | | | |
| MSc (Appl.Sc) Mining | | | | | | | | | | |
| MSc (Appl.Sc) Geotechnics | | | | | | | | | | |
| MSc (Appl.Sc) Structural Technology | | | | | | | | | | |
| MSc (Appl.Sc) Transportation Planning | | | | | | | | | | |

| UKZN | | | | | | | | | |
|---|-------------|--------|-----------|-----------|---|-------------|--------|-----------|-----------|
| Masters | | | | | PhD | | | | |
| Course | Course-work | Thesis | Full time | Part time | Course | Course-work | Thesis | Full time | Part time |
| | | | | | | | | | |
| Bioresources Engineering | | x | x | x | Bioresources Engineering | | x | x | x |
| Chemical Engineering | | x | x | x | Chemical Engineering | | x | x | x |
| Civil Engineering | | x | x | x | Civil Engineering | | x | x | x |
| Electrical, Electronic & Computer Engineering | | x | x | x | Electrical, Electronic & Computer Engineering | | x | x | x |
| Mechanical Engineering | | x | x | x | Mechanical Engineering | | x | x | x |

| NMU | | | | | | | | | |
|--------------------------------------|--------------|--------|-----------|-----------|--|-------------|--------|-----------|-----------|
| Masters | | | | | PhD | | | | |
| Course | Course-work | Thesis | Full time | Part time | Course | Course-work | Thesis | Full time | Part time |
| | | | | | | | | | |
| Master of Engineering (Electrical) | Dissertation | | x | x | Doctor of Philosophy in Engineering (Mechanical) | | x | x | x |
| Master of Engineering (Industrial) | Dissertation | | x | x | Doctor of Philosophy in Engineering (Mechatronics) | | x | x | x |
| Master of Engineering (Mechanical) | Dissertation | | x | x | | | | | |
| Master of Engineering (Mechatronics) | Dissertation | | x | x | | | | | |

| NWU | | | | | | | | | | | | | | |
|--|-----------------------|--------|-----------|-----------|--|-------------|----------------------|----------------------|-----------|--------|-------------|--------|--|-----------|
| Masters | | | | PhD | | | | Postgraduate Diploma | | | | | | |
| Course | Course-work | Thesis | Full time | Part time | Course | Course-work | Thesis | Full time | Part time | Course | Course-work | Thesis | Full time | Part time |
| | Master of Engineering | | | | | | Doctor of Philosophy | | x | | x | x | PG Diploma in Nuclear Science and Technology | x |
| MEng in Chemical Engineering | | x | x | x | PhD in Chemical Engineering | | x | x | x | | | | | |
| MEng in Computer & Electronic Engineering | | x | x | x | PhD in Computer Engineering | | x | x | x | | | | | |
| MEng in Electrical & Electronic Engineering | | x | x | x | PhD in Computer & Electronic Engineering | | x | x | x | | | | | |
| MEng in Mechanical Engineering | | x | x | x | PhD in Electronic Engineering | | x | x | x | | | | | |
| MEng in Nuclear Engineering | x | x | x | x | PhD in Electrical Engineering | | x | x | x | | | | | |
| | | | | | PhD in Electrical & Electronic Engineering | | x | x | x | | | | | |
| Master of Science in Engineering Sciences | | | | | PhD in Mechanical Engineering | | x | x | x | | | | | |
| MSc in Chemical Engineering | | x | x | x | PhD in Nuclear Engineering | | x | x | x | | | | | |
| MSc in Computer & Electronic Engineering | | x | x | x | PhD in Engineering Science | | x | x | x | | | | | |
| MSc in Electrical & Electronic Engineering | | x | x | x | PhD in Industrial Engineering | | x | x | x | | | | | |
| MSc in Mechanical Engineering | | x | x | x | | | | | | | | | | |
| MSc in Nuclear Engineering | | x | x | x | | | | | | | | | | |

| SU | | | | | | | | | | | | | | |
|---|-------------|--------------|-----------|-----------|--------------------------------------|---------------------------|--------|----------------------|-----------|--|------------------------|--------|-----------|-----------|
| Masters | | | | PhD | | | | Postgraduate Diploma | | | | | | |
| Course | Course-work | Thesis | Full time | Part time | Course | Course-work | Thesis | Full time | Part time | Course | Course-work | Thesis | Full time | Part time |
| | | | | | | | | | | | | | | |
| Master of Engineering (MEng by Coursework) | | | | | Doctor of Philosophy (PhD) | | | | | Postgraduate Diploma in Engineering (PGDip (Engineering)) | | | | |
| Civil Engineering | x | | | | Civil Engineering | Dissertation | | | | Civil Engineering | | | | |
| Industrial Engineering | x | | | | Electrical Engineering | Dissertation | | | | Industrial Engineering | | | | |
| Industrial Engineering (Engineering Management) | x | | | | Electronic Engineering | Dissertation | | | | Mechanical and Mechatronic Engineering | discontinued from 2016 | | | |
| Mechanical Engineering | x | | | | Extractive Metallurgical Engineering | | x | x | | process (Chemical) Engineering | x | | x | |
| Master of Engineering (MEng) in Smart Grid Technology (Structured) | x | short thesis | | | Industrial Engineering | Dissertation | | | | | | | | |
| Master of Engineering (MEng by Research) | | | | | Mechanical Engineering | Dissertation | | | | | | | | |
| Civil Engineering | x | | | | Mechatronic Engineering | Dissertation | | | | | | | | |
| Electrical Engineering | x | | | | Process (Chemical) Engineering | | x | x | | | | | | |
| Electronic Engineering | x | | | | | | | | | | | | | |
| Engineering Management | x | | | | Doctor of Engineering (DEng) | | | | | | | | | |
| Extractive Metallurgical Engineering | x | x | | | Includes all engineering branches | Research and publications | | | | | | | | |
| Industrial Engineering (Engineering Management) | x | | | | | | | | | | | | | |
| Mechanical Engineering | | x | | | | | | | | | | | | |
| Mechatronic Engineering | | x | | | | | | | | | | | | |
| Process (Chemical) Engineering | x | x | | | | | | | | | | | | |

| Wits | | | | | | | | | | | | | | |
|--|-------------|--------|-----------|-----------|-----------------------------------|-------------|--------|----------------------|-----------|----------------------------------|-------------|--------|-----------|-----------|
| Masters | | | | PhD | | | | Postgraduate Diploma | | | | | | |
| Course | Course-work | Thesis | Full time | Part time | Course | Course-work | Thesis | Full time | Part time | Course | Course-work | Thesis | Full time | Part time |
| Master of Engineering MEng (Professional) | | | | | Doctor of Philosophy (PhD) | | | | | PG Diploma in Engineering | | | | |
| Civil Engineering | | | | | Civil & Environmental Engineering | x | | x | x | | | | | |
| Geotechnical and Materials Engineering | x | | x | x | | | | | | | | | | |
| Water Engineering | x | | x | x | | | | | | | | | | |
| Structural Engineering | x | | x | x | | | | | | | | | | |
| Environmental Engineering | x | | x | x | | | | | | | | | | |
| Project and Construction Management | x | | x | x | | | | | | | | | | |
| Master of Science in Engineering (MSc(Eng)) | | | | | | | | | | | | | | |
| Civil & Environmental Engineering | | | | | | | | | | | | | | |
| Geotechnical and Materials Engineering | x | x | x | x | | | | | | | | | | |
| Water Engineering | x | x | x | x | | | | | | | | | | |
| Structural Engineering | x | x | x | x | | | | | | | | | | |
| Project and Construction Management | x | x | x | x | | | | | | | | | | |
| Environmental Engineering | x | x | x | x | | | | | | | | | | |
| Electrical Engineering | | | | | Aeronautical Engineering | x | | x | x | Welding Design | x | | x | x |
| Telecommunications | x | | x | x | Systems Engineering | x | | x | x | Welding Metallurgy | x | | x | x |
| Information and Software Engineering | x | | x | x | | | | | | | | | | |
| Power Engineering | | | | | Senior Doctorate | | | | | | | | | |
| Industrial Engineering | | | | | Doctor of Engineering (DEng) | | | | x | | | | | |
| Engineering Management | x | | x | x | Doctor of Science in Engineering | | | | x | | | | | |
| Industrial Engineering | x | | x | x | | | | | | | | | | |
| Systems Engineering | x | | x | x | | | | | | | | | | |
| Mechanical Engineering | x | | x | x | | | | | | | | | | |
| Aeronautical Engineering | x | | x | x | | | | | | | | | | |

Wits

| Wits | | | | | | | | | | | | | |
|--|---|---|---|---|--|--|--|--|--|--|--|--|--|
| Master of Science in Engineering (MSc(Eng)) | | | | | | | | | | | | | |
| Aeronautical Engineering | x | | x | x | | | | | | | | | |
| Electrical Engineering | x | | x | x | | | | | | | | | |
| Engineering Management | x | | x | x | | | | | | | | | |
| Industrial Engineering | x | | x | x | | | | | | | | | |
| Mechanical Engineering | x | | x | x | | | | | | | | | |
| Systems Engineering | x | | x | x | | | | | | | | | |
| Metallurgy and Materials Engineering | | | | | | | | | | | | | |
| Coal science and technology | x | | x | x | | | | | | | | | |
| Extractive metallurgy | x | | x | x | | | | | | | | | |
| Pyrometallurgy | x | | x | x | | | | | | | | | |
| Materials science and engineering | x | | x | x | | | | | | | | | |
| Welding engineering | x | | x | x | | | | | | | | | |
| Mining Engineering | x | x | x | x | | | | | | | | | |
| Civil & Environmental Engineering | | | | | | | | | | | | | |
| Geotechnical and Materials Engineering | x | | x | x | | | | | | | | | |
| Water Engineering | x | | x | x | | | | | | | | | |
| Structural Engineering | x | | x | x | | | | | | | | | |
| Project and Construction Management | x | | x | x | | | | | | | | | |
| Environmental Engineering | x | | x | x | | | | | | | | | |
| Chemical Engineering | | | | | | | | | | | | | |
| Advanced Chemical Engineering | x | | x | x | | | | | | | | | |
| Petroleum, Oil and Gas Engineering | x | | x | x | | | | | | | | | |
| Coal Science and Technology | x | | x | x | | | | | | | | | |
| Clean Energy and sustainable Technologies | x | | x | x | | | | | | | | | |
| Mechanical Engineering | | | | | | | | | | | | | |
| Nuclear Technology Leadership | x | | x | x | | | | | | | | | |

| CPUT | | | | | | | | |
|--|-------------|--------|-----------|-----------|---|-------------|--------|-----------|
| Masters | | | | Doctorate | | | | |
| Course | Course-work | Thesis | Full time | Part time | Course | Course-work | Thesis | Full time |
| Master of Engineering in Chemical Engineering | | x | x | x | Doctor of Engineering in Chemical Engineering | | x | x |
| Environmental Engineering and Bioproducts Technology | | x | x | x | Environmental Engineering and Bioproducts Technology | | x | x |
| Hydrometallurgy, Biotechnology and Mineral Processing | | | x | x | Hydrometallurgy, Biotechnology and Mineral Processing | | x | x |
| Oil and Gas Technology | | | x | x | Oil and Gas Technology | | x | x |
| Master of Engineering in Civil Engineering | | | x | x | Doctor of Engineering in Civil Engineering | | x | x |
| MTech: Cartography | | x | x | | N/A | | | |
| Master of Construction | | x | x | x | N/A | | | |
| Master of Engineering in Electrical Engineering | | x | x | | DEng in Electrical Engineering | | x | x |
| MTech: Engineering Electrical (Course Work) | x | | x | x | | | | |
| Master of Engineering in Quality | | x | x | x | N/A | | | |
| Master of Engineering in Mechanical Engineering | x | x | x | x | Doctor of Engineering in Mechanical Engineering | | x | x |

| DUT | | | | | | | | | |
|------------------------------|-------------|--------|-----------|-----------|---------------------------|-------------|--------|-----------|-----------|
| Masters | | | | PhD | | | | | |
| Course | Course-work | Thesis | Full time | Part time | Course | Course-work | Thesis | Full time | Part time |
| Master of Engineering | | | | | Doctor Engineering | | | | |
| Electronic Engineering | | x | x | x | Civil Engineering | | x | x | x |
| Civil Engineering | | x | x | x | Chemical Engineering | | x | x | x |
| Electrical Engineering | | x | x | x | Electrical Engineering | | x | x | x |
| Chemical Engineering | | x | x | x | Electronic Engineering | | x | x | x |
| Industrial Engineering | | x | x | x | Industrial Engineering | | x | x | x |
| Mechanical Engineering | | x | x | x | Mechanical Engineering | | x | x | x |

TUT

| Masters | | | | | PhD | | | | |
|-------------------------------|---|--------|-----------|-----------|------------------------------|---|--------|-----------|-----------|
| Course | Course-work | Thesis | Full time | Part time | Course | Course-work | Thesis | Full time | Part time |
| Masters of Engineering | | | | | Doctor of Engineering | | | | |
| Chemical | | x | x | x | Chemical | | x | x | x |
| Civil | | x | x | x | Civil | | x | x | x |
| Electrical | | x | x | x | Industrial | | x | x | x |
| Mechanical | | x | x | x | Materials | | x | x | x |
| Metallurgical | | x | x | x | Polymer Technology | | x | x | x |
| Polymer Technology | | x | x | x | Metallurgical | | x | x | x |
| Industrial | | x | x | x | Electrical | | x | x | x |
| Engineering Management | | x | x | x | Doctor Technologiae | Currently being phased out, 31 Dec 2018 | | | |
| | | | | | Chemical | | x | x | x |
| Magister Technologiae | Currently being phased out, 31 Dec 2018 | | | | Metallurgy | | x | x | x |
| Chemical | | x | x | x | Polymer Technology | | x | x | x |
| Metallurgy | | x | x | x | Electrical | | x | x | x |
| Polymer Technology | | x | x | x | Civil | | x | x | x |
| Mechanical | | x | x | x | Industrial | | x | x | x |

| VUT | | | | | | | | | |
|-------------------------------|-------------|--------|-----------|-----------|------------------------------|-------------|--------|-----------|-----------|
| Masters | | | | PhD | | | | | |
| Course | Course-work | Thesis | Full time | Part time | Course | Course-work | Thesis | Full time | Part time |
| Masters of Engineering | | | | | Doctor of Engineering | | | | |
| Electrical | | x | | | Electrical | | x | x | |
| Electronic | | | | | Mechanical | | x | x | |
| Mechanical | | x | | | Civil | | x | x | |
| Metallurgy | | x | | | Chemical | | x | x | |
| Industrial | | x | | | | | | | |
| Civil | | x | | | | | | | |
| Chemical | | x | | | | | | | |

| Unisa | | | | | | | | | |
|--|-------------|--------|-----------|-----------|--|-------------|--------|-----------|-----------|
| Masters | | | | PhD | | | | | |
| Course | Course-work | Thesis | Full time | Part time | Course | Course-work | Thesis | Full time | Part time |
| | | | | | | | | | |
| Magister Technologiae: Engineering: Chemical (98989) | | x | | | Doctor of Philosophy Science, Engineering and Technology (90040 - SET) | | x | | |
| Magister Technologiae: Engineering: Electrical (98988) | | x | | | | | | | |

APPENDIX C

DEMOGRAPHICS OF STAFF AT THE HEIs³⁵

| UKZN | | | | | | | | | |
|--------------------------|--|-----------------|-------|-------|---------|--------|-------|---------|-------------------|
| | | TOTAL NUMBER | MALE | | | FEMALE | | | NO INFO ONLINE |
| | | | BLACK | WHITE | UNKNOWN | BLACK | WHITE | UNKNOWN | |
| BIORESOURCES ENGINEERING | FULL PROFESSOR | 2 | | 2 | | | | | |
| | ASSOCIATE PROFESSOR | 1 | 1 | | | | | | |
| | EMERITUS PROFESSOR | 1 | | 1 | | | | | |
| | SENIOR LECTURER | 1 | 1 | | | | | | |
| | LECTURER | 1 | | 1 | | | | | |
| | JUNIOR LECTURER | 0 | | | | | | | |
| | POST DOCS | 0 | | | | | | | |
| | TEMPORARY/ CONTRACT OR PART TIME | 0 | | | | | | | |
| | TECHNICIANS | 3 | | 3 | | | | | |
| | ADMINISTRATIVE | 4 | 1 | 1 | | | 1 | 1 | |
| | RESEARCH OFFICERS | 1 | | 1 | | | | | |
| | ADJUNCT / EXTRAORDINARY | 0 | | | | | | | |
| | VISITING STAFF | 0 | | | | | | | |

³⁵ Insufficient information obtained for UJ,CUT and TUT.

| UKZN | | | | | | | | | |
|--|--|----------------|---|---|---|---|---|---|--|
| CHEMICAL ENGINEERING | FULL PROFESSOR | 6 | 3 | 2 | 1 | | | | |
| | ASSOCIATE PROFESSOR | 1 | | | | 1 | | | |
| | EMERITUS PROFESSOR | 2 | | 2 | | | | | |
| | SENIOR LECTURER | 1 | | 1 | | | | | |
| | LECTURER | 9 | 6 | 1 | | 2 | | | |
| | JUNIOR LECTURER | 0 | | | | | | | |
| | ACADEMIC LEADER | 2 | 1 | 1 | | | | | |
| | POST DOCS | 1 | | 1 | | | | | |
| | TEMPORARY/ CONTRACT OR PART TIME | 0 | | | | | | | |
| | TECHNICIANS | 0 | | | | | | | |
| | ADMINISTRATIVE | 0 | | | | | | | |
| | RESEARCH OFFICERS | 4 | 1 | 2 | | | 1 | | |
| | ADJUNCT / EXTRAORDINARY VISITING STAFF | 0 | | | | | | | |
| | | | | | | | | | |
| | CIVIL ENGINEERING | FULL PROFESSOR | 2 | | 1 | | | 1 | |
| ASSOCIATE PROFESSOR | | 1 | | 1 | | | | | |
| EMERITUS PROFESSOR | | 1 | | 1 | | | | | |
| SENIOR LECTURER | | 2 | | 2 | | | | | |
| LECTURER | | 6 | 2 | | | 1 | 3 | | |
| JUNIOR LECTURER | | 0 | | | | | | | |
| POST DOCS | | 0 | | | | | | | |
| TEMPORARY/ CONTRACT OR PART TIME | | 0 | | | | | | | |
| TECHNICIANS | | 0 | | | | | | | |
| ADMINISTRATIVE | | 0 | | | | | | | |
| RESEARCH OFFICERS | | 0 | | | | | | | |
| ADJUNCT / EXTRAORDINARY VISITING STAFF | | 0 | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |

UKZN

| | | | | | | | | |
|-------------------------------|---|----|---|---|---|---|--|---|
| ELECTRICAL ENGINEERING | FULL PROFESSOR | 4 | 3 | 1 | | | | |
| | ASSOCIATE PROFESSOR | 1 | 1 | | | | | |
| | EMERITUS PROFESSOR | 0 | | | | | | |
| | SENIOR LECTURER | 7 | 7 | | | | | |
| | LECTURER | 9 | 7 | 1 | | 1 | | |
| | JUNIOR LECTURER | 0 | | | | | | |
| | POST DOCS | 0 | | | | | | |
| | TEMPORARY/ CONTRACT OR PART TIME | 0 | | | | | | |
| | TECHNICIANS | 16 | 7 | 1 | 3 | 1 | | 4 |
| | ADMINISTRATIVE | 4 | 1 | | | 1 | | 2 |
| | RESEARCH OFFICERS | 1 | | 1 | | | | |
| | SENIOR SCHOLAR | 0 | | | | | | |
| | ADJUNCT / EXTRAORDINARY VISITING STAFF | 0 | | | | | | |
| | | | | | | | | |
| MECHANICAL ENGINEERING | FULL PROFESSOR | 3 | 1 | 1 | 1 | | | |
| | ASSOCIATE PROFESSOR | 2 | | 2 | | | | |
| | EMERITUS PROFESSOR | 0 | | | | | | |
| | SENIOR LECTURER | 2 | | 2 | | | | |
| | LECTURER | 3 | | 3 | | | | |
| | JUNIOR LECTURER | 0 | | | | | | |
| | POST DOCS | 0 | | | | | | |
| | TEMPORARY/ CONTRACT / PART TIME / OCCASIONAL | 0 | | | | | | |
| | TECHNICIANS | 0 | | | | | | |
| | ADMINISTRATIVE | 2 | | | | 2 | | |
| | RESEARCH OFFICERS | 3 | 1 | 2 | | | | |
| | ADJUNCT / EXTRAORDINARY VISITING STAFF | 0 | | | | | | |
| | | 0 | | | | | | |

| UNISA | | | | | | | | | |
|-----------------------------------|--|-----------------|-------|-------|---------|--------|-------|---------|-------------------|
| | | TOTAL NUMBER | MALE | | | FEMALE | | | NO INFO ONLINE |
| | | | BLACK | WHITE | UNKNOWN | BLACK | WHITE | UNKNOWN | |
| CHEMICAL AND CIVIL ENGINEERING | HEAD | 1 | | | | | 1 | | |
| | FULL PROFESSOR | 2 | | 1 | | | 1 | | |
| | ASSOCIATE PROFESSOR | 5 | 1 | | | 4 | | | |
| | EMERITUS PROFESSOR | 0 | | | | | | | |
| | SENIOR LECTURER | 4 | 2 | 1 | | 1 | | | |
| | LECTURER | 3 | | | | 2 | 1 | | |
| | JUNIOR LECTURER | 3 | | | | 3 | | | |
| | POST DOCS | 2 | 2 | | | | | | |
| | TEMPORARY/ CONTRACT OR PART TIME | 0 | | | | | | | |
| | TECHNICIANS | 5 | 3 | | | 2 | | | |
| | ADMINISTRATIVE | 3 | 1 | | | 2 | | | |
| | RESEARCH OFFICERS | 0 | | | | | | | |
| | ADJUNCT / EXTRAORDINARY VISITING STAFF | 0 | | | | | | | |
| | | | | | | | | | |
| ELECTRICAL AND MINING ENGINEERING | HEAD | 1 | | 1 | | | | | |
| | FULL PROFESSOR | 2 | 2 | | | | | | |
| | ASSOCIATE PROFESSOR | 1 | 1 | | | | | | |
| | EMERITUS PROFESSOR | 0 | | | | | | | |
| | SENIOR LECTURER | 5 | 4 | 1 | | | | | |
| | LECTURER | 6 | 6 | | | | | | |
| | JUNIOR LECTURER | 0 | | | | | | | |
| | POST DOCS | 0 | | | | | | | |
| | TEMPORARY/ CONTRACT OR PART TIME | 0 | | | | | | | |
| | TECHNICIANS | 2 | 1 | | | 1 | | | |
| | ADMINISTRATIVE | 2 | | | | | 2 | | |
| | RESEARCH OFFICERS | 1 | | 1 | | | | | |
| | SENIOR SCHOLAR | 0 | | | | | | | |
| | ADJUNCT / EXTRAORDINARY VISITING STAFF | 0 | | | | | | | |

| UNISA | | | | | | | | | |
|---------------------------------------|---|---|---|---|--|---|--|--|--|
| INDUSTRIAL AND MECHANICAL ENGINEERING | ASSOCIATE CHAIR | 7 | 6 | 1 | | | | | |
| | FULL PROFESSOR | 1 | 1 | | | | | | |
| | ASSOCIATE PROFESSOR | 1 | 1 | | | | | | |
| | EMERITUS PROFESSOR | 0 | | | | | | | |
| | SENIOR LECTURER | 2 | 2 | | | | | | |
| | LECTURER | 6 | 3 | 2 | | 1 | | | |
| | JUNIOR LECTURER | 8 | 7 | | | 1 | | | |
| | POST DOCS | 1 | 1 | | | | | | |
| | TEMPORARY/ CONTRACT / PART TIME / OCCASIONAL | 0 | | | | | | | |
| | TECHNICIANS | 2 | 2 | | | | | | |
| | ADMINISTRATIVE | 6 | 3 | | | 3 | | | |
| | RESEARCH OFFICERS | 0 | | | | | | | |
| | ADJUNCT / EXTRAORDINARY | 0 | | | | | | | |
| | VISITING STAFF | 0 | | | | | | | |

| UCT | | | | | | | | | |
|----------------------------|--|--------|-------|-------|---------|--------|-------|---------|---------|
| | | TOTAL | MALE | | | FEMALE | | | NO INFO |
| | | NUMBER | BLACK | WHITE | UNKNOWN | BLACK | WHITE | UNKNOWN | ONLINE |
| CHEMICAL ENGINEERING | FULL PROFESSOR | 14 | 1 | 8 | 0 | 0 | 5 | 0 | |
| | ASSOCIATE PROFESSOR | 4 | 1 | 2 | 0 | 0 | 1 | 0 | |
| | EMERITUS PROFESSOR | 1 | 0 | 1 | 0 | 0 | 0 | 0 | |
| | SENIOR LECTURER | 5 | 2 | 3 | 0 | 0 | 0 | 0 | |
| | LECTURER | 5 | 1 | 0 | 0 | 2 | 2 | 0 | |
| | JUNIOR LECTURER | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| | POST DOCS | 17 | 8 | 4 | 0 | 2 | 3 | 0 | |
| | TEMPORARY/ CONTRACT OR PART TIME | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| | TECHNICIANS | 24 | 11 | 4 | 1 | 5 | 1 | 2 | |
| | ADMINISTRATIVE | 16 | 0 | 0 | 2 | 0 | 0 | 14 | |
| | RESEARCH OFFICERS | 15 | 2 | 7 | 0 | 0 | 6 | 0 | |
| | ADJUNCT / EXTRAORDINARY | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| | VISITING STAFF | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| CIVIL ENGINEERING | FULL PROFESSOR | 6 | 2 | 4 | 0 | 0 | 0 | 0 | |
| | ASSOCIATE PROFESSOR | 4 | 0 | 3 | 0 | 0 | 1 | 0 | |
| | EMERITUS PROFESSOR | 1 | 0 | 1 | 0 | 0 | 0 | 0 | |
| | SENIOR LECTURER | 4 | 2 | 1 | 0 | 0 | 1 | 0 | |
| | LECTURER | 2 | 1 | 0 | 0 | 1 | 0 | 0 | |
| | JUNIOR LECTURER | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| | POST DOCS | 3 | 0 | 2 | 0 | 1 | 0 | 0 | |
| | TEMPORARY/ CONTRACT OR PART TIME | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| | TECHNICIANS | 7 | 0 | 0 | 7 | 0 | 0 | 0 | |
| | ADMINISTRATIVE | 7 | 0 | 0 | 2 | 0 | 0 | 5 | |
| | RESEARCH OFFICERS | 2 | 0 | 1 | 0 | 0 | 1 | 0 | |
| ADJUNCT / EXTRAORDINARY | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| VISITING STAFF | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |

| | | UCT | | | | | | | |
|-------------------------|---|-----|----|----|----|---|----|---|--|
| ELECTRICAL ENGINEERING | FULL PROFESSOR | 6 | 3 | 3 | 0 | 0 | 0 | 0 | |
| | ASSOCIATE PROFESSOR | 8 | 3 | 3 | 0 | 1 | 1 | 0 | |
| | EMERITUS PROFESSOR | 9 | 0 | 9 | 0 | 0 | 0 | 0 | |
| | SENIOR LECTURER | 6 | 3 | 1 | 0 | 1 | 1 | 0 | |
| | LECTURER | 4 | 1 | 1 | 0 | 1 | 1 | 0 | |
| | JUNIOR LECTURER | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| | POST DOCS | 3 | 1 | 1 | 0 | 0 | 1 | 0 | |
| | TEMPORARY/ CONTRACT OR PART TIME | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| | TECHNICIANS | 6 | 1 | 4 | 1 | 0 | 0 | 0 | |
| | ADMINISTRATIVE | 7 | 0 | 1 | 0 | 4 | 2 | 0 | |
| | RESEARCH OFFICERS | 0 | 0 | 0 | 0 | 0 | 0 | 0 | included above in other categories as research officers also hold other designations |
| | SENIOR SCHOLAR | 1 | 0 | 1 | 0 | 0 | 0 | 0 | |
| | ADJUNCT / EXTRAORDINARY | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| VISITING STAFF | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| MECHANICAL ENGINEERING | FULL PROFESSOR | 7 | 2 | 4 | 0 | 0 | 1 | 0 | |
| | ASSOCIATE PROFESSOR | 6 | 1 | 5 | 0 | 0 | 0 | 0 | |
| | EMERITUS PROFESSOR | 4 | 1 | 3 | 0 | 0 | 0 | 0 | |
| | SENIOR LECTURER | 10 | 4 | 3 | 0 | 2 | 0 | 1 | |
| | LECTURER | 2 | 0 | 0 | 0 | 1 | 1 | 0 | |
| | JUNIOR LECTURER | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| | POST DOCS | 4 | 1 | 1 | 0 | 0 | 2 | 0 | |
| | TEMPORARY/ CONTRACT / PART TIME / OCCASIONAL | 2 | 0 | 2 | 0 | 0 | 0 | 0 | |
| | TECHNICIANS | 11 | 0 | 0 | 10 | 0 | 0 | 1 | |
| | ADMINISTRATIVE | 20 | 1 | 3 | 2 | 7 | 1 | 6 | |
| | RESEARCH OFFICERS | 35 | 11 | 10 | 0 | 0 | 14 | 0 | |
| ADJUNCT / EXTRAORDINARY | 1 | 0 | 1 | 0 | 0 | 0 | 0 | | |
| VISITING STAFF | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |

| Wits | | | | | | | | | |
|--|----------------------------------|--------------|-------|-------|---------|--------|-------|---------|----------------|
| | | TOTAL NUMBER | MALE | | | FEMALE | | | NO INFO ONLINE |
| | | | BLACK | WHITE | UNKNOWN | BLACK | WHITE | UNKNOWN | |
| CHEMICAL ENGINEERING | FULL PROFESSOR | 5 | 1 | 3 | | | 1 | | |
| | ASSOCIATE PROFESSOR | 4 | 1 | 1 | | 1 | 1 | | |
| | EMERITUS PROFESSOR | 1 | | 1 | | | | | |
| | SENIOR LECTURER | 12 | 3 | 3 | 2 | | 1 | | 3 |
| | LECTURER | 8 | 4 | 1 | | 1 | 1 | | 1 |
| | JUNIOR LECTURER | 0 | | | | | | | |
| | POST DOCS | 0 | | | | | | | |
| | TEMPORARY/ CONTRACT OR PART TIME | 0 | | | | | | | |
| | TECHNICIANS | 0 | | | | | | | |
| | ADMINISTRATIVE | 0 | | | | | | | |
| | RESEARCH OFFICERS | 1 | | | 1 | | | | |
| | ADJUNCT / EXTRAORDINARY | 1 | | 1 | | | | | |
| | VISITING STAFF | 3 | | 1 | | | 2 | | |
| CIVIL ENGINEERING | FULL PROFESSOR | 6 | 3 | 3 | | | | | |
| | ASSOCIATE PROFESSOR | 4 | 3 | | | | 1 | | |
| | EMERITUS PROFESSOR | 0 | | | | | | | |
| | SENIOR LECTURER | 8 | 2 | 4 | | 1 | 1 | | |
| | LECTURER | 0 | | | | | | | |
| | JUNIOR LECTURER | 0 | | | | | | | |
| | POST DOCS | 0 | | | | | | | |
| | TEMPORARY/ CONTRACT OR PART TIME | 0 | | | | | | | |
| | TECHNICIANS | 5 | 1 | 3 | | 1 | | | |
| | ADMINISTRATIVE | 0 | | | | | | | |
| | RESEARCH OFFICERS | 0 | | | | | | | |
| | ADJUNCT / EXTRAORDINARY | 0 | | | | | | | |
| | VISITING STAFF | 0 | | | | | | | |
| ELECTRICAL AND INFORMATION ENGINEERING | FULL PROFESSOR | 9 | 2 | 5 | | | 2 | | |
| | ASSOCIATE PROFESSOR | 7 | 2 | 4 | | | | | 1 |
| | EMERITUS PROFESSOR | 2 | | 2 | | | | | |
| | SENIOR LECTURER | 7 | 3 | 3 | | 1 | | | |
| | LECTURER | 9 | 2 | 5 | | 1 | 1 | | |
| | JUNIOR LECTURER | 0 | | | | | | | |
| | ASSOCIATE LECTURER | 1 | 1 | | | | | | |
| | POST DOCS | 0 | | | | | | | |
| | TEMPORARY/ CONTRACT OR PART TIME | 0 | | | | | | | |
| | TECHNICIANS | 6 | 4 | 2 | | | | | |
| | ADMINISTRATIVE | 6 | | | | 4 | 2 | | |
| | RESEARCH OFFICERS | 0 | | | | | | | |
| | SENIOR SCHOLAR | 0 | | | | | | | |
| | ADJUNCT / EXTRAORDINARY | 1 | | 1 | | | | | |
| | VISITING STAFF | 2 | | 1 | | | 1 | | |

| | | Wits | | | | | | | |
|--|--|------|---|---|---|---|---|---|---|
| INDUSTRIAL AERONAUTICAL MECHANICAL ENGINEERING | FULL PROFESSOR | 4 | 3 | 1 | | | | | |
| | ASSOCIATE PROFESSOR | 7 | 1 | 4 | 1 | | 1 | | |
| | EMERITUS PROFESSOR | 1 | | 1 | | | | | |
| | SENIOR LECTURER | 7 | 2 | 4 | | | 1 | | |
| | LECTURER | 11 | 3 | 5 | | 2 | 1 | | |
| | JUNIOR LECTURER | 0 | | | | | | | |
| | ASSOCIATE LECTURER | 4 | | 3 | | 1 | | | |
| | POST DOCS | 0 | | | | | | | |
| | TEMPORARY/ CONTRACT / PART TIME / OCCASIONAL | 0 | | | | | | | |
| | TECHNICIANS | 11 | 8 | 3 | | | | | |
| | ADMINISTRATIVE | 7 | | 1 | | 4 | 2 | | |
| | RESEARCH OFFICERS | 8 | | 3 | 1 | 2 | 2 | | |
| | ADJUNCT / EXTRAORDINARY | 1 | | 1 | | | | | |
| VISITING STAFF | 0 | | | | | | | | |
| MINING ENGINEERING | FULL PROFESSOR | 2 | 1 | 1 | | | | | |
| | ASSOCIATE PROFESSOR | 3 | 1 | 1 | 1 | | | | |
| | EMERITUS PROFESSOR | 3 | | 2 | | | 1 | | |
| | SENIOR LECTURER | 6 | 2 | 4 | | | | | |
| | LECTURER | 8 | 4 | | | 4 | | | |
| | JUNIOR LECTURER | 0 | | | | | | | |
| | ASSOCIATE LECTURER | 2 | 1 | | | 1 | | | |
| | POST DOCS | 0 | | | | | | | |
| | TEMPORARY/ CONTRACT OR PART TIME | 0 | | | | | | | |
| | TECHNICIANS | 4 | 3 | | 1 | | | | |
| | ADMINISTRATIVE | 7 | 1 | | 1 | | | 1 | 4 |
| | RESEARCH OFFICERS | 3 | | 1 | 2 | | | | |
| | ADJUNCT / EXTRAORDINARY | 1 | | 1 | | | | | |
| VISITING STAFF | 4 | 2 | | | | 1 | 1 | | |

| | | UP | | | | | | | |
|----------------------|----------------------------------|--------------|-------|-------|---------|--------|-------|---------|----------------|
| | | TOTAL NUMBER | MALE | | | FEMALE | | | NO INFO ONLINE |
| | | | BLACK | WHITE | UNKNOWN | BLACK | WHITE | UNKNOWN | |
| CHEMICAL ENGINEERING | FULL PROFESSOR | 3 | | 3 | | | | | |
| | ASSOCIATE PROFESSOR | 6 | 3 | 3 | | | | | |
| | EMERITUS PROFESSOR | 0 | | | | | | | |
| | SENIOR LECTURER | 7 | 1 | 4 | | | 2 | | |
| | LECTURER | 0 | | | | | | | |
| | JUNIOR LECTURER | 0 | | | | | | | |
| | POST DOCS | 0 | | | | | | | |
| | TEMPORARY/ CONTRACT OR PART TIME | 1 | | 1 | | | | | |
| | TECHNICIANS | 5 | 1 | 2 | | | 2 | | |
| | ADMINISTRATIVE | 3 | | | | 1 | | 2 | |
| | RESEARCH OFFICERS | 1 | | 1 | | | | | |
| | ADJUNCT / EXTRAORDINARY | 1 | | | | | 1 | | |
| | VISITING STAFF | 0 | | | | | | | |

| UP | | | | | | | | | |
|------------------------|--|----|---|---|---|---|---|--|---|
| CIVIL ENGINEERING | FULL PROFESSOR | 11 | 1 | 9 | | | 1 | | |
| | ASSOCIATE PROFESSOR | 3 | | 2 | | | | | 1 |
| | EMERITUS PROFESSOR | 0 | | | | | | | |
| | SENIOR LECTURER | 2 | | 1 | | | 1 | | |
| | LECTURER | 4 | | 1 | | | 3 | | |
| | JUNIOR LECTURER | 0 | | | | | | | |
| | POST DOCS | 0 | | | | | | | |
| | TEMPORARY/ CONTRACT OR PART TIME | 0 | | | | | | | |
| | TECHNICIANS | 16 | 7 | 5 | | 1 | 3 | | |
| | ADMINISTRATIVE | 2 | | | | | 2 | | |
| | RESEARCH OFFICERS | 3 | | 3 | | | | | |
| | ADJUNCT / EXTRAORDINARY VISITING STAFF | 0 | | | | | | | |
| | | | | | | | | | |
| ELECTRICAL ENGINEERING | FULL PROFESSOR | 9 | 2 | 7 | | | | | |
| | ASSOCIATE PROFESSOR | 5 | 1 | 3 | 1 | | | | |
| | EMERITUS PROFESSOR | 0 | | | | | | | |
| | SENIOR LECTURER | 10 | 1 | 6 | | | 2 | | 1 |
| | LECTURER | 3 | 1 | 2 | | | | | |
| | JUNIOR LECTURER | 0 | | | | | | | |
| | POST DOCS | 0 | | | | | | | |
| | TEMPORARY/ CONTRACT OR PART TIME | 0 | | | | | | | |
| | TECHNICIANS | 8 | 3 | | 4 | 1 | | | |
| | ADMINISTRATIVE | 8 | 1 | | | 1 | 6 | | |
| | RESEARCH OFFICERS | 0 | | | | | | | |
| | SENIOR SCHOLAR | 0 | | | | | | | |
| | ADJUNCT / EXTRAORDINARY VISITING STAFF | 3 | | 1 | 2 | | | | |
| | 0 | | | | | | | | |
| INDUSTRIAL ENGINEERING | HEAD | 1 | 1 | | | | | | |
| | FULL PROFESSOR | 0 | | | | | | | |
| | ASSOCIATE PROFESSOR | 1 | | 1 | | | | | |
| | EMERITUS PROFESSOR | 0 | | | | | | | |
| | SENIOR LECTURER | 5 | 2 | 1 | | | 2 | | |
| | LECTURER | 4 | | 1 | | | 3 | | |
| | ASSISTANT LECTURER | 5 | 1 | 1 | | | 3 | | |
| | JUNIOR LECTURER | 0 | | | | | | | |
| | POST DOCS | 0 | | | | | | | |
| | TEMPORARY/ CONTRACT / PART TIME / OCCASIONAL | 1 | | 1 | | | | | |
| | TECHNICIANS | 0 | | | | | | | |
| | ADMINISTRATIVE | 3 | 1 | | | | 2 | | |
| | RESEARCH OFFICERS | 0 | | | | | | | |
| | ADJUNCT / EXTRAORDINARY VISITING STAFF | 0 | | | | | | | |
| | | 0 | | | | | | | |

| UP | | | | | | | | |
|---|--|----|---|---|---|---|--|---|
| MATERIAL SCIENCES AND METALLURGICAL ENGINEERING | HEAD | 1 | | 1 | | | | |
| | FULL PROFESSOR | 2 | | | | 2 | | |
| | ASSOCIATE PROFESSOR | 2 | 1 | 1 | | | | |
| | EMERITUS PROFESSOR | 0 | | | | | | |
| | SENIOR LECTURER | 5 | | 4 | | 1 | | |
| | LECTURER | 1 | 1 | | | | | |
| | ASSISTANT LECTURER | 0 | | | | | | |
| | JUNIOR LECTURER | 1 | | 1 | | | | |
| | POST DOCS | 0 | | | | | | |
| | TEMPORARY/ CONTRACT / PART TIME / OCCASIONAL | 7 | 1 | 4 | | | | 2 |
| | TECHNICIANS | 1 | | 1 | | | | |
| | ADMINISTRATIVE | 1 | | | | 1 | | |
| | RESEARCH OFFICERS | 0 | | | | | | |
| | HONARARY | 7 | | 5 | | 2 | | |
| | ADJUNCT / EXTRAORDINARY | 1 | | 1 | | | | |
| VISITING STAFF | 0 | | | | | | | |
| MECHANICAL AND AERONAUTICAL ENGINEERING | HEAD | 3 | | 3 | | | | |
| | FULL PROFESSOR | 2 | | 2 | | | | |
| | ASSOCIATE PROFESSOR | 6 | | 5 | 1 | | | |
| | EMERITUS PROFESSOR | 1 | | 1 | | | | |
| | SENIOR LECTURER | 12 | 4 | 7 | | 1 | | |
| | LECTURER | 9 | 1 | 6 | | 2 | | |
| | ASSISTANT LECTURER | 0 | | | | | | |
| | JUNIOR LECTURER | 0 | | | | | | |
| | POST DOCS | 0 | | | | | | |
| | TEMPORARY/ CONTRACT / PART TIME / OCCASIONAL | 0 | | | | | | |
| | TECHNICIANS | 8 | 5 | 3 | | | | |
| | ADMINISTRATIVE | 2 | 2 | | | | | |
| | RESEARCH OFFICERS | 13 | 8 | 5 | | | | |
| | HONARARY | 0 | | | | | | |
| | ADJUNCT / EXTRAORDINARY | 6 | 1 | 4 | | 1 | | |
| VISITING STAFF | 0 | | | | | | | |

| UP | | | | | | | | |
|----------------------------|---|---|---|---|--|---|---|--|
| MINING ENGINEERING | HEAD | 0 | | | | | | |
| | FULL PROFESSOR | 1 | | 1 | | | | |
| | ASSOCIATE PROFESSOR | 0 | | | | | | |
| | EMERITUS PROFESSOR | 0 | | | | | | |
| | SENIOR LECTURER | 3 | | 3 | | | | |
| | LECTURER | 1 | | | | | 1 | |
| | ASSISTANT LECTURER | 7 | 2 | 3 | | 1 | 1 | |
| | JUNIOR LECTURER | 0 | | | | | | |
| | POST DOCS | 0 | | | | | | |
| | TEMPORARY/ CONTRACT / PART TIME / OCCASIONAL | 0 | | | | | | |
| | TECHNICIANS | 0 | | | | | | |
| | ADMINISTRATIVE | 6 | 1 | | | 2 | 3 | |
| | RESEARCH OFFICERS | 5 | 1 | 4 | | | | |
| | HONARARY | 0 | | | | | | |
| ADJUNCT / EXTRAORDINARY | 5 | 1 | 4 | | | | | |
| VISITING STAFF | 0 | | | | | | | |

| CPUT | | | | | | | | | |
|----------------------|-------------------------------------|-----------------|-------|-------|---------|--------|-------|---------|-------------------|
| | | TOTAL NUMBER | MALE | | | FEMALE | | | NO INFO ONLINE |
| | | | BLACK | WHITE | UNKNOWN | BLACK | WHITE | UNKNOWN | |
| CHEMICAL ENGINEERING | HEAD | 1 | 1 | | | | | | |
| | FULL PROFESSOR | 0 | | | | | | | |
| | ASSOCIATE PROFESSOR | 2 | 1 | 1 | | | | | |
| | EMERITUS PROFESSOR | 0 | | | | | | | |
| | SENIOR LECTURER | 7 | 4 | 1 | 2 | | | | |
| | LECTURER | 12 | 6 | | | 3 | 1 | 2 | |
| | JUNIOR LECTURER | 1 | | | | | 1 | | |
| | POST DOCS | 0 | | | | | | | |
| | TEMPORARY/ CONTRACT OR PART TIME | 0 | | | | | | | |
| | TECHNICIANS | 4 | 1 | 1 | | 1 | 1 | | |
| | ADMINISTRATIVE | 3 | | | 1 | | | 2 | |
| | RESEARCH OFFICERS | 0 | | | | | | | |
| | ADJUNCT / EXTRAORDINARY | 0 | | | | | | | |
| | VISITING STAFF | 0 | | | | | | | |
| CIVIL ENGINEERING | FULL PROFESSOR | 2 | | 1 | | | 1 | | |
| | ASSOCIATE PROFESSOR | 1 | | | | | 1 | | |
| | EMERITUS PROFESSOR | 0 | | | | | | | |
| | SENIOR LECTURER | 0 | | | | | | | |
| | LECTURER | 0 | | | | | | | |
| | JUNIOR LECTURER | 0 | | | | | | | |
| | POST DOCS | 0 | | | | | | | |
| | TEMPORARY/ CONTRACT OF PART TIME | 0 | | | | | | | |
| | TECHNICIANS | 3 | 2 | 1 | | | | | |
| | ADMINISTRATIVE | 2 | 1 | | | 1 | | | |
| | RESEARCH OFFICERS | 2 | | 2 | | | | | |
| | ADJUNCT / EXTRAORDINARY | 2 | 2 | | | | | | |
| VISITING STAFF | 0 | | | | | | | | |

| | | CPUT | | | | | | | |
|------------------------|---|---|---|---|---|---|--|--|--|
| ELECTRICAL ENGINEERING | FULL PROFESSOR | 1 | 1 | | | | | | |
| | ASSOCIATE PROFESSOR | 0 | | | | | | | |
| | EMERITUS PROFESSOR | 0 | | | | | | | |
| | SENIOR LECTURER | 5 | 1 | 2 | 2 | | | | |
| | LECTURER | 4 | | 2 | 2 | | | | |
| | JUNIOR LECTURER | 0 | | | | | | | |
| | POST DOCS | 1 | 1 | | | | | | |
| | TEMPORARY/ CONTRACT OR PART TIME | 0 | | | | | | | |
| | TECHNICIANS | 1 | | | 1 | | | | |
| | ADMINISTRATIVE | 1 | | | | 1 | | | |
| | RESEARCH OFFICERS | 2 | | 2 | | | | | |
| | SENIOR SCHOLAR | 0 | | | | | | | |
| | ADJUNCT / EXTRAORDINARY | 0 | | | | | | | |
| VISITING STAFF | 0 | | | | | | | | |
| MECHANICAL ENGINEERING | FULL PROFESSOR | | | | | | | | |
| | | NO STAFF LIST FOR MECHANICAL ENGINEERING AVAILABLE ONLINE | | | | | | | |
| | ASSOCIATE PROFESSOR | | | | | | | | |
| | EMERITUS PROFESSOR | | | | | | | | |
| | SENIOR LECTURER | | | | | | | | |
| | LECTURER | | | | | | | | |
| | JUNIOR LECTURER | | | | | | | | |
| | POST DOCS | | | | | | | | |
| | TEMPORARY/ CONTRACT / PART TIME / OCCASIONAL | | | | | | | | |
| | TECHNICIANS | | | | | | | | |
| | ADMINISTRATIVE | | | | | | | | |
| | RESEARCH OFFICERS | | | | | | | | |
| | ADJUNCT / EXTRAORDINARY | | | | | | | | |
| | VISITING STAFF | | | | | | | | |

| SU | | | | | | | | | |
|----------------------------|-------------------------------------|--------|-------|-------|---------|--------|-------|---------|---------|
| | | TOTAL | MALE | | | FEMALE | | | NO INFO |
| | | NUMBER | BLACK | WHITE | UNKNOWN | BLACK | WHITE | UNKNOWN | ONLINE |
| CHEMICAL ENGINEERING | FULL PROFESSOR | 3 | | 3 | | | | | |
| | ASSOCIATE PROFESSOR | 5 | 1 | 2 | | | 1 | | 1 |
| | EMERITUS PROFESSOR | 0 | | | | | | | |
| | SENIOR LECTURER | 5 | | 3 | | 1 | 1 | | |
| | LECTURER | 4 | | 2 | | 1 | 1 | | |
| | JUNIOR LECTURER | 0 | | | | | | | |
| | POST DOCS | 9 | 2 | 3 | | 2 | 2 | | |
| | TEMPORARY/ CONTRACT OR PART TIME | 1 | | 1 | | | | | |
| | TECHNICIANS | 11 | | 1 | | | | | 10 |
| | ADMINISTRATIVE | 5 | | | | | | | 5 |
| | RESEARCH OFFICERS | 1 | | 1 | | | | | |
| | ADJUNCT / EXTRAORDINARY | 7 | | 6 | | | 1 | | |
| | VISITING STAFF | 0 | | | | | | | |
| CIVIL ENGINEERING | HEAD | 4 | | 3 | | | 1 | | |
| | FULL PROFESSOR | 3 | | 3 | | | | | |
| | ASSOCIATE PROFESSOR | 3 | | 3 | | | | | |
| | EMERITUS PROFESSOR | 3 | | 3 | | | | | |
| | SENIOR LECTURER | 8 | | 7 | | | 1 | | |
| | LECTURER | 10 | 1 | 3 | | | 6 | | |
| | JUNIOR LECTURER | 0 | | | | | | | |
| | POST DOCS | 0 | | | | | | | |
| | TEMPORARY/ CONTRACT OR PART TIME | 0 | | | | | | | |
| | TECHNICIANS | 12 | 7 | 5 | | | | | |
| | ADMINISTRATIVE | 9 | 1 | | | 2 | 6 | | |
| | RESEARCH OFFICERS | 1 | | | | | | | 1 |
| | ADJUNCT / EXTRAORDINARY | 6 | | 5 | | | | | 1 |
| VISITING STAFF | 0 | | | | | | | | |
| ELECTRICAL ENGINEERING | HEAD | 1 | | 1 | | | | | |
| | FULL PROFESSOR | 1 | | 9 | | | | | |
| | ASSOCIATE PROFESSOR | 1 | 1 | 5 | | | | | |
| | EMERITUS PROFESSOR | 1 | | | | | | | |
| | SENIOR LECTURER | 1 | | 7 | | | | | |
| | LECTURER | 1 | 1 | 5 | | 1 | | | |
| | JUNIOR LECTURER | 1 | 1 | 2 | | | 1 | | |
| | POST DOCS | 1 | | 1 | | | | | 2 |
| | TEMPORARY/ CONTRACT OR PART TIME | 1 | | | | | | | |
| | TECHNICIANS | 1 | 3 | 6 | | | | | 2 |
| | ADMINISTRATIVE | 1 | 2 | | | 1 | 3 | | 1 |
| | RESEARCH OFFICERS | 1 | | | | | | | 1 |
| | SENIOR SCHOLAR | 1 | | | | | | | |
| ADJUNCT / EXTRAORDINARY | 1 | | | | | | | 2 | |
| VISITING STAFF | 1 | | | | | | | | |

| SU | | | | | | | | |
|------------------------|---|----|---|----|--|---|--|----|
| INDUSTRIAL ENGINEERING | FULL PROFESSOR | 3 | | 3 | | | | |
| | ASSOCIATE PROFESSOR | 3 | | 3 | | | | |
| | EMERITUS PROFESSOR | 0 | | | | | | |
| | SENIOR LECTURER | 8 | 1 | 6 | | 1 | | |
| | LECTURER | 8 | 1 | 5 | | 2 | | |
| | JUNIOR LECTURER | 1 | | 1 | | | | |
| | POST DOCS | 0 | | | | | | |
| | TEMPORARY/ CONTRACT / PART TIME / OCCASIONAL | 0 | | | | | | |
| | TECHNICIANS | 0 | | | | | | |
| | ADMINISTRATIVE | 5 | | | | 5 | | |
| | RESEARCH OFFICERS | 0 | | | | | | |
| | ADJUNCT / EXTRAORDINARY | 12 | | 12 | | | | |
| VISITING STAFF | 0 | | | | | | | |
| MECHANICAL ENGINEERING | FULL PROFESSOR | 8 | 1 | 5 | | | | 2 |
| | ASSOCIATE PROFESSOR | 1 | | 1 | | | | |
| | EMERITUS PROFESSOR | 1 | | 1 | | | | |
| | SENIOR LECTURER | 12 | | 8 | | 3 | | 1 |
| | LECTURER | 11 | 1 | 7 | | 1 | | 2 |
| | JUNIOR LECTURER | 0 | | | | | | |
| | POST DOCS | 0 | | | | | | |
| | TEMPORARY/ CONTRACT / PART TIME / OCCASIONAL | 0 | | | | | | |
| | TECHNICIANS | 12 | 1 | 1 | | | | 10 |
| | ADMINISTRATIVE | 9 | 1 | | | 6 | | 2 |
| | RESEARCH OFFICERS | 1 | | | | | | 1 |
| | ADJUNCT / EXTRAORDINARY | 8 | 1 | 6 | | | | 1 |
| VISITING STAFF | 0 | | | | | | | |

| VUT | | | | | | | | | |
|----------------------------|-------------------------------------|--------|-------|-------|---------|--------|-------|---------|-------------------|
| | | TOTAL | MALE | | | FEMALE | | | NO INFO ONLINE |
| | | NUMBER | BLACK | WHITE | UNKNOWN | BLACK | WHITE | UNKNOWN | |
| CHEMICAL ENGINEERING | FULL PROFESSOR | 1 | 1 | | | | | | |
| | ASSOCIATE PROFESSOR | 1 | 1 | | | | | | |
| | EMERITUS PROFESSOR | 0 | | | | | | | |
| | SENIOR LECTURER | 2 | 1 | | | 1 | | | |
| | LECTURER | 5 | 3 | | | 1 | 1 | | |
| | JUNIOR LECTURER | 0 | | | | | | | |
| | POST DOCS | 0 | | | | | | | |
| | TEMPORARY/ CONTRACT OR PART TIME | 0 | | | | | | | |
| | TECHNICIANS | 4 | 2 | | | 2 | | | |
| | ADMINISTRATIVE | 1 | | | | | 1 | | |
| | RESEARCH OFFICERS | 0 | | | | | | | |
| ADJUNCT / EXTRAORDINARY | 0 | | | | | | | | |
| VISITING STAFF | 0 | | | | | | | | |

| VUT | | | | | | | | | |
|------------------------|--|---|---|---|--|--|---|----|--|
| CIVIL ENGINEERING | FULL PROFESSOR | 1 | | | | | | 1 | |
| | ASSOCIATE PROFESSOR | 0 | | | | | | | |
| | EMERITUS PROFESSOR | 0 | | | | | | | |
| | SENIOR LECTURER | 0 | | | | | | | |
| | LECTURER | 11 | | | | | | 11 | |
| | JUNIOR LECTURER | 0 | | | | | | | |
| | POST DOCS | 0 | | | | | | | |
| | TEMPORARY/ CONTRACT OR PART TIME | 0 | | | | | | | |
| | TECHNICIANS | 5 | | | | | | 5 | |
| | ADMINISTRATIVE | 1 | | | | | | 1 | |
| | RESEARCH OFFICERS | 0 | | | | | | | |
| | ADJUNCT / EXTRAORDINARY | 0 | | | | | | | |
| | VISITING STAFF | 0 | | | | | | | |
| ELECTRICAL ENGINEERING | FULL PROFESSOR | NO STAFF LIST FOR ELECTRICAL ENGINEERING AVAILABLE ONLINE | | | | | | | |
| | ASSOCIATE PROFESSOR | | | | | | | | |
| | EMERITUS PROFESSOR | | | | | | | | |
| | SENIOR LECTURER | | | | | | | | |
| | LECTURER | | | | | | | | |
| | JUNIOR LECTURER | | | | | | | | |
| | POST DOCS | | | | | | | | |
| | TEMPORARY/ CONTRACT OR PART TIME | | | | | | | | |
| | TECHNICIANS | | | | | | | | |
| | ADMINISTRATIVE | | | | | | | | |
| | RESEARCH OFFICERS | | | | | | | | |
| | SENIOR SCHOLAR | | | | | | | | |
| | ADJUNCT / EXTRAORDINARY | | | | | | | | |
| VISITING STAFF | | | | | | | | | |
| MECHANICAL ENGINEERING | FULL PROFESSOR | 2 | 1 | | | | | 1 | |
| | ASSOCIATE PROFESSOR | 0 | | | | | | | |
| | EMERITUS PROFESSOR | 0 | | | | | | | |
| | SENIOR LECTURER | 1 | 1 | | | | | | |
| | LECTURER | 12 | 6 | 6 | | | | | |
| | JUNIOR LECTURER | 0 | | | | | | | |
| | POST DOCS | 0 | | | | | | | |
| | TEMPORARY/ CONTRACT / PART TIME / OCCASIONAL | 1 | | | | | | 1 | |
| | TECHNICIANS | 7 | 2 | 2 | | | | 3 | |
| | ADMINISTRATIVE | 4 | | 2 | | | 2 | | |
| | RESEARCH OFFICERS | 0 | | | | | | | |
| | ADJUNCT / EXTRAORDINARY | 0 | | | | | | | |
| | VISITING STAFF | 0 | | | | | | | |

| VUT | | | | | | | | |
|--|--|---|---|--|---|---|---|---|
| INDUSTRIAL ENGINEERING & OPERATIONS MANAGEMENT | ACADEMIC UNKNOWN DESIGNATION | 6 | 5 | | | | 1 | |
| | FULL PROFESSOR | 1 | 1 | | | | | |
| | ASSOCIATE PROFESSOR | 0 | | | | | | |
| | EMERITUS PROFESSOR | 0 | | | | | | |
| | SENIOR LECTURER | 0 | | | | | | |
| | LECTURER | 0 | | | | | | |
| | JUNIOR LECTURER | 0 | | | | | | |
| | POST DOCS | 0 | | | | | | |
| | TEMPORARY/ CONTRACT / PART TIME / OCCASIONAL | 0 | | | | | | |
| | TECHNICIANS | 0 | | | | | | |
| | ADMINISTRATIVE | 2 | | | | | 2 | |
| | RESEARCH OFFICERS | 0 | | | | | | |
| | ADJUNCT / EXTRAORDINARY | 0 | | | | | | |
| VISITING STAFF | 0 | | | | | | | |
| | | | | | | | | |
| METALLURGICAL ENGINEERING | HOD | 1 | | | 1 | | | |
| | FULL PROFESSOR | 0 | | | | | | |
| | ASSOCIATE PROFESSOR | 1 | | | | | | 1 |
| | EMERITUS PROFESSOR | 0 | | | | | | |
| | SENIOR LECTURER | 2 | | | 1 | | | 1 |
| | LECTURER | 4 | 1 | | 1 | 1 | | 1 |
| | JUNIOR LECTURER | 0 | | | | | | |
| | POST DOCS | 0 | | | | | | |
| | TEMPORARY/ CONTRACT / PART TIME / OCCASIONAL | 2 | | | 2 | | | |
| | TECHNICIANS | 4 | 2 | | | 2 | | |
| | TUTOR | 4 | | | | | | 4 |
| | ADMINISTRATIVE | 0 | | | | | | |
| | RESEARCH OFFICERS | 0 | | | | | | |
| | ADJUNCT / EXTRAORDINARY | 0 | | | | | | |
| VISITING STAFF | 0 | | | | | | | |

TUT

STAFF RECORDS FOR TUT WERE NOT COMPLETE PER SCHOOL/DEPARTMENT

| | | TOTAL | MALE | | | FEMALE | | | NO INFO |
|-------------------------------|----------------------------------|--------|-------|-------|---------|--------|-------|---------|---------|
| | | NUMBER | BLACK | WHITE | UNKNOWN | BLACK | WHITE | UNKNOWN | ONLINE |
| CHEMICAL ENGINEERING | FULL PROFESSOR | 2 | 1 | | | 1 | | | |
| | ASSOCIATE PROFESSOR | | | | | | | | |
| | EMERITUS PROFESSOR | | | | | | | | |
| | SENIOR LECTURER | | | | | | | | |
| | LECTURER | | | | | | | | |
| | JUNIOR LECTURER | | | | | | | | |
| | POST DOCS | | | | | | | | |
| | TEMPORARY/ CONTRACT OR PART TIME | | | | | | | | |
| | TECHNICIANS | | | | | | | | |
| | ADMINISTRATIVE | | | | | | | | |
| | RESEARCH OFFICERS | | | | | | | | |
| | ADJUNCT / EXTRAORDINARY | | | | | | | | |
| | VISITING STAFF | | | | | | | | |
| | | | | | | | | | |
| CIVIL ENGINEERING | FULL PROFESSOR | | | | | | | | |
| | ASSOCIATE PROFESSOR | | | | | | | | |
| | EMERITUS PROFESSOR | | | | | | | | |
| | SENIOR LECTURER | | | | | | | | |
| | LECTURER | | | | | | | | |
| | JUNIOR LECTURER | | | | | | | | |
| | POST DOCS | | | | | | | | |
| | TEMPORARY/ CONTRACT OR PART TIME | | | | | | | | |
| | TECHNICIANS | | | | | | | | |
| | ADMINISTRATIVE | | | | | | | | |
| | RESEARCH OFFICERS | | | | | | | | |
| | ADJUNCT / EXTRAORDINARY | | | | | | | | |
| | VISITING STAFF | | | | | | | | |
| | | | | | | | | | |
| ELECTRICAL ENGINEERING | FULL PROFESSOR | 5 | 4 | 1 | | | | | |
| | ASSOCIATE PROFESSOR | | | | | | | | |
| | EMERITUS PROFESSOR | | | | | | | | |
| | SENIOR LECTURER | | | | | | | | |
| | LECTURER | | | | | | | | |
| | JUNIOR LECTURER | | | | | | | | |
| | POST DOCS | | | | | | | | |
| | TEMPORARY/ CONTRACT OR PART TIME | | | | | | | | |
| | TECHNICIANS | | | | | | | | |
| | ADMINISTRATIVE | | | | | | | | |
| | RESEARCH OFFICERS | | | | | | | | |
| | SENIOR SCHOLAR | | | | | | | | |
| | ADJUNCT / EXTRAORDINARY | | | | | | | | |
| | VISITING STAFF | | | | | | | | |
| | | | | | | | | | |

| TUT | | | | | | | | | |
|------------------------|---|--|---|--|--|--|---|--|--|
| MECHANICAL ENGINEERING | FULL PROFESSOR | | | | | | | | |
| | ASSOCIATE PROFESSOR | | | | | | | | |
| | EMERITUS PROFESSOR | | | | | | | | |
| | SENIOR LECTURER | | | | | | | | |
| | LECTURER | | | | | | | | |
| | JUNIOR LECTURER | | | | | | | | |
| | POST DOCS | | | | | | | | |
| | TEMPORARY/ CONTRACT / PART TIME / OCCASIONAL | | | | | | | | |
| | TECHNICIANS | | | | | | | | |
| | ADMINISTRATIVE | | | | | | | | |
| | RESEARCH OFFICERS | | | | | | | | |
| | ADJUNCT / EXTRAORDINARY | | | | | | | | |
| VISITING STAFF | | | | | | | | | |
| | | | | | | | | | |
| INDUSTRIAL ENGINEERING | FULL PROFESSOR | | 1 | | | | 1 | | |
| | ASSOCIATE PROFESSOR | | | | | | | | |
| | EMERITUS PROFESSOR | | | | | | | | |
| | SENIOR LECTURER | | | | | | | | |
| | LECTURER | | | | | | | | |
| | JUNIOR LECTURER | | | | | | | | |
| | POST DOCS | | | | | | | | |
| | TEMPORARY/ CONTRACT OR PART TIME | | | | | | | | |
| | TECHNICIANS | | | | | | | | |
| | ADMINISTRATIVE | | | | | | | | |
| | RESEARCH OFFICERS | | | | | | | | |
| | ADJUNCT / EXTRAORDINARY | | | | | | | | |
| VISITING STAFF | | | | | | | | | |

| DUT | | | | | | | | | |
|----------------------------|-------------------------------------|-----------------|-------|-------|---------|--------|-------|---------|-------------------|
| | | TOTAL NUMBER | MALE | | | FEMALE | | | NO INFO ONLINE |
| | | | BLACK | WHITE | UNKNOWN | BLACK | WHITE | UNKNOWN | |
| CHEMICAL ENGINEERING | FULL PROFESSOR | 1 | 1 | | | | | | |
| | ASSOCIATE PROFESSOR | 1 | 1 | | | | | | |
| | EMERITUS PROFESSOR | 0 | | | | | | | |
| | SENIOR LECTURER | 5 | 2 | | 1 | | | | 2 |
| | LECTURER | 3 | 2 | | | 1 | | | |
| | JUNIOR LECTURER | 0 | | | | | | | |
| | POST DOCS | 0 | | | | | | | |
| | TEMPORARY/ CONTRACT OR PART TIME | 0 | | | | | | | |
| | TECHNICIANS | 5 | 3 | | 1 | 1 | | | |
| | ADMINISTRATIVE | 1 | | | | 1 | | | |
| | RESEARCH OFFICERS | 0 | | | | | | | |
| | ADJUNCT / EXTRAORDINARY | 0 | | | | | | | |
| VISITING STAFF | 0 | | | | | | | | |
| CIVIL ENGINEERING | HOD | 2 | | | 2 | | | | |
| | ASSOCIATE DIRECTOR | 2 | | | 1 | | | | 1 |
| | FULL PROFESSOR | 0 | | | | | | | |
| | ASSOCIATE PROFESSOR | 0 | | | | | | | |
| | EMERITUS PROFESSOR | 0 | | | | | | | |
| | SENIOR LECTURER | 3 | 3 | | | | | | |
| | LECTURER | 23 | 10 | | 8 | 4 | | 1 | |
| | JUNIOR LECTURER | 4 | | | 1 | 3 | | | |
| | POST DOCS | 0 | | | | | | | |
| | TEMPORARY/ CONTRACT OR PART TIME | 0 | | | | | | | |
| | TECHNICIANS | 8 | 6 | | 2 | | | | |
| | ADMINISTRATIVE | 2 | 1 | | | | | 1 | |
| | RESEARCH OFFICERS | 0 | | | | | | | |
| ADJUNCT / EXTRAORDINARY | 0 | | | | | | | | |
| VISITING STAFF | 0 | | | | | | | | |
| ELECTRICAL ENGINEERING | HOD | 1 | 1 | | | | | | |
| | FULL PROFESSOR | 1 | | | | | | | 1 |
| | ASSOCIATE PROFESSOR | 0 | | | | | | | |
| | EMERITUS PROFESSOR | 0 | | | | | | | |
| | SENIOR LECTURER | 1 | | | 1 | | | | |
| | LECTURER | 5 | 1 | | 4 | | | | |
| | JUNIOR LECTURER | 3 | 1 | | 1 | | | 1 | |
| | POST DOCS | 0 | | | | | | | |
| | TEMPORARY/ CONTRACT OR PART TIME | 0 | | | | | | | |
| | TECHNICIANS | 3 | 1 | | 2 | | | | |
| | ADMINISTRATIVE | 1 | | | | 1 | | | |
| | RESEARCH OFFICERS | 0 | | | | | | | |
| | SENIOR SCHOLAR | 0 | | | | | | | |
| ADJUNCT / EXTRAORDINARY | 0 | | | | | | | | |
| VISITING STAFF | 0 | | | | | | | | |

| | | DUT | | | | | | | |
|-------------------------|--|-----|---|--|---|---|---|--|---|
| MECHANICAL ENGINEERING | HOD | 1 | | | 1 | | | | |
| | DEPUTY HOD | 1 | 1 | | | | | | |
| | FULL PROFESSOR | 3 | | | | | | | 3 |
| | ASSOCIATE PROFESSOR | 1 | | | | | | | 1 |
| | EMERITUS PROFESSOR | 0 | | | | | | | |
| | SENIOR LECTURER | 2 | 1 | | 1 | | | | |
| | LECTURER | 6 | 4 | | 1 | | | | 1 |
| | JUNIOR LECTURER | 0 | | | | | | | |
| | POST DOCS | 0 | | | | | | | |
| | TEMPORARY/ CONTRACT / PART TIME / OCCASIONAL | 0 | | | | | | | |
| | TECHNICIANS | 6 | 6 | | | | | | |
| | ADMINISTRATIVE | 0 | | | | | | | |
| | RESEARCH OFFICERS | 0 | | | | | | | |
| | ADJUNCT / EXTRAORDINARY | 0 | | | | | | | |
| VISITING STAFF | 0 | | | | | | | | |
| ELECTRONIC ENGINEERING | HOD | 1 | | | 1 | | | | |
| | DEPUTY HOD | 1 | 1 | | | | | | |
| | DIRECTOR | 1 | 1 | | | | | | |
| | ASSOCIATE DIRECTOR | 1 | | | 1 | | | | |
| | FULL PROFESSOR | 0 | | | | | | | |
| | ASSOCIATE PROFESSOR | 1 | | | | | | | 1 |
| | EMERITUS PROFESSOR | 0 | | | | | | | |
| | SENIOR LECTURER | 5 | 1 | | 2 | | | | 2 |
| | LECTURER | 9 | 6 | | 1 | 1 | | | 1 |
| | JUNIOR LECTURER | 0 | | | | | | | |
| | POST DOCS | 0 | | | | | | | |
| | TEMPORARY/ CONTRACT OR PART TIME | 0 | | | | | | | |
| | TECHNICIANS | 7 | 1 | | 6 | | | | |
| | SNR TECHNICAL ASSISTANTS | 2 | 2 | | | | | | |
| | ADMINISTRATIVE | 1 | | | | | 1 | | |
| | RESEARCH OFFICERS | 0 | | | | | | | |
| | SENIOR SCHOLAR | 0 | | | | | | | |
| ADJUNCT / EXTRAORDINARY | 0 | | | | | | | | |
| VISITING STAFF | 0 | | | | | | | | |

| | | DUT | | | | | | | |
|------------------------|-------------------------------------|-----|---|--|---|--|---|---|--|
| INDUSTRIAL ENGINEERING | HOD | 1 | 1 | | | | | | |
| | FULL PROFESSOR | 0 | | | | | | | |
| | ASSOCIATE PROFESSOR | 0 | | | | | | | |
| | EMERITUS PROFESSOR | 0 | | | | | | | |
| | SENIOR LECTURER | 1 | 1 | | | | | | |
| | LECTURER | 4 | | | 3 | | | 1 | |
| | JUNIOR LECTURER | 0 | | | | | | | |
| | POST DOCS | 0 | | | | | | | |
| | TEMPORARY/ CONTRACT OR PART TIME | 0 | | | | | | | |
| | TECHNICIANS | 1 | | | 1 | | | | |
| | SNR TECHNICAL ASSISTANTS | 0 | | | | | | | |
| | ADMINISTRATIVE | 1 | | | | | 1 | | |
| | RESEARCH OFFICERS | 0 | | | | | | | |
| | SENIOR SCHOLAR | 0 | | | | | | | |
| | ADJUNCT / EXTRAORDINARY | 0 | | | | | | | |
| VISITING STAFF | 0 | | | | | | | | |

| | | NMU | | | | | | | |
|------------------------------------|-------------------------------------|--------|-------|-------|---------|--------|-------|---------|---------|
| | | TOTAL | MALE | | | FEMALE | | | NO INFO |
| | | NUMBER | BLACK | WHITE | UNKNOWN | BLACK | WHITE | UNKNOWN | ONLINE |
| INDUSTRIAL ENGINEERING | HOD | 1 | | | | | 1 | | |
| | FULL PROFESSOR | 0 | | | | | | | |
| | ASSOCIATE PROFESSOR | 0 | | | | | | | |
| | EMERITUS PROFESSOR | 0 | | | | | | | |
| | SENIOR LECTURER | 2 | | 2 | | | | | |
| | LECTURER | 3 | | 2 | | | 1 | | |
| | JUNIOR LECTURER | 0 | | | | | | | |
| | POST DOCS | 0 | | | | | | | |
| | TEMPORARY/ CONTRACT OR PART TIME | 0 | | | | | | | |
| | TECHNICIANS | 0 | | | | | | | |
| | ADMINISTRATIVE | 1 | | | | | 1 | | |
| | RESEARCH OFFICERS | 0 | | | | | | | |
| | ADJUNCT / EXTRAORDINARY | 0 | | | | | | | |
| | VISITING STAFF | 0 | | | | | | | |
| | CIVIL ENGINEERING | HOD | 1 | | 1 | | | | |
| FULL PROFESSOR | | 0 | | | | | | | |
| ASSOCIATE PROFESSOR | | 0 | | | | | | | |
| EMERITUS PROFESSOR | | 0 | | | | | | | |
| SENIOR LECTURER | | 0 | | | | | | | |
| LECTURER | | 4 | 1 | 1 | | 1 | 1 | | |
| JUNIOR LECTURER | | 0 | | | | | | | |
| POST DOCS | | 0 | | | | | | | |
| TEMPORARY/ ONTRACT OF PART TIME | | 0 | | | | | | | |
| TECHNICIANS | | 1 | 1 | | | | | | |
| ADMINISTRATIVE | | 1 | | | | 1 | | | |
| RESEARCH OFFICERS | | 0 | | | | | | | |
| ADJUNCT / EXTRAORDINARY | | 0 | | | | | | | |
| VISITING STAFF | | 0 | | | | | | | |
| | | 0 | | | | | | | |

| NMU | | | | | | | | |
|----------------------------|---|---|---|---|---|---|---|---|
| ELECTRICAL ENGINEERING | HOD | 1 | | 1 | | | | |
| | FULL PROFESSOR | 0 | | | | | | |
| | ASSOCIATE PROFESSOR | 0 | | | | | | |
| | EMERITUS PROFESSOR | 0 | | | | | | |
| | SENIOR LECTURER | 0 | | | | | | |
| | LECTURER | 0 | | | | | | |
| | JUNIOR LECTURER | 0 | | | | | | |
| | POST DOCS | 0 | | | | | | |
| | TEMPORARY/ CONTRACT OR PART TIME | 0 | | | | | | |
| | TECHNICIANS | 4 | 3 | 1 | | | | |
| | ADMINISTRATIVE | 0 | | | | | | |
| | RESEARCH OFFICERS | 0 | | | | | | |
| | SENIOR SCHOLAR | 0 | | | | | | |
| ADJUNCT / EXTRAORDINARY | 0 | | | | | | | |
| VISITING STAFF | 0 | | | | | | | |
| MECHANICAL ENGINEERING | HOD | 1 | | | 1 | | | |
| | FULL PROFESSOR | 1 | | 1 | | | | |
| | ASSOCIATE PROFESSOR | 1 | | | | 1 | | |
| | EMERITUS PROFESSOR | 0 | | | | | | |
| | PRINCIPAL LECTURER | 1 | | 1 | | | | |
| | SENIOR LECTURER | 2 | | 2 | | | | |
| | LECTURER | 4 | | 2 | 2 | | | |
| | JUNIOR LECTURER | 0 | | | | | | |
| | POST DOCS | 0 | | | | | | |
| | TEMPORARY/ CONTRACT / PART TIME / OCCASIONAL | 1 | | | | | 1 | |
| | TECHNICIANS | 4 | 1 | 2 | | | | 1 |
| | ADMINISTRATIVE | 1 | | | | 1 | | |
| | RESEARCH OFFICERS | 0 | | | | | | |
| ADJUNCT / EXTRAORDINARY | 0 | | | | | | | |
| VISITING STAFF | 0 | | | | | | | |
| MECHATRONICS | HOD | 0 | | | | | | |
| | FULL PROFESSOR | 4 | 2 | 1 | 1 | | | |
| | ASSOCIATE PROFESSOR | 0 | | | | | | |
| | EMERITUS PROFESSOR | 0 | | | | | | |
| | PRINCIPAL LECTURER | 0 | | | | | | |
| | SENIOR LECTURER | 0 | | | | | | |
| | LECTURER | 0 | | | | | | |
| | JUNIOR LECTURER | 0 | | | | | | |
| | POST DOCS | 0 | | | | | | |
| | TEMPORARY/ CONTRACT / PART TIME / OCCASIONAL | 0 | | | | | | |
| | TECHNICIANS | 1 | | | 1 | | | |
| | ADMINISTRATIVE | 2 | | | | | 2 | |
| | RESEARCH OFFICERS | 0 | | | | | | |
| ADJUNCT / EXTRAORDINARY | 0 | | | | | | | |
| VISITING STAFF | 0 | | | | | | | |

NWU

| | | TOTAL NUMBER | MALE | | | FEMALE | | | NO INFO ONLINE |
|--|-------------------------------------|--------------|-------|-------|---------|--------|-------|---------|----------------|
| | | | BLACK | WHITE | UNKNOWN | BLACK | WHITE | UNKNOWN | |
| CHEMICAL AND MINERALS ENGINEERING | FULL PROFESSOR | 3 | | 2 | | | 1 | | |
| | ASSOCIATE PROFESSOR | 0 | | | | | | | |
| | EMERITUS PROFESSOR | 0 | | | | | | | |
| | SENIOR LECTURER | 0 | | | | | | | |
| | LECTURER | 0 | | | | | | | |
| | JUNIOR LECTURER | 0 | | | | | | | |
| | POST DOCS | 0 | | | | | | | |
| | TEMPORARY/ CONTRACT OR PART TIME | 0 | | | | | | | |
| | TECHNICIANS | 0 | | | | | | | |
| | ADMINISTRATIVE | 0 | | | | | | | |
| | RESEARCH OFFICERS | 0 | | | | | | | |
| | ADJUNCT / EXTRAORDINARY | 0 | | | | | | | |
| | VISITING STAFF | 0 | | | | | | | |
| ELECTRICAL, ELECTRONIC AND COMPUTER ENGINEERING | FULL PROFESSOR | 4 | | 3 | | | 1 | | |
| | ASSOCIATE PROFESSOR | 0 | | | | | | | |
| | EMERITUS PROFESSOR | 0 | | | | | | | |
| | SENIOR LECTURER | 0 | | | | | | | |
| | LECTURER | 0 | | | | | | | |
| | JUNIOR LECTURER | 0 | | | | | | | |
| | POST DOCS | 0 | | | | | | | |
| | TEMPORARY/ CONTRACT OR PART TIME | 0 | | | | | | | |
| | TECHNICIANS | 0 | | | | | | | |
| | ADMINISTRATIVE | 0 | | | | | | | |
| | RESEARCH OFFICERS | 0 | | | | | | | |
| | ADJUNCT / EXTRAORDINARY | 0 | | | | | | | |
| | VISITING STAFF | 0 | | | | | | | |

| | | NMU | | | | | | | |
|---|--|-----|---|---|--|--|---|--|--|
| MECHANICAL AND NUCLEAR ENGINEERING | FULL PROFESSOR | 3 | | 3 | | | | | |
| | ASSOCIATE PROFESSOR | 2 | | 2 | | | | | |
| | EMERITUS PROFESSOR | 0 | | | | | | | |
| | SENIOR LECTURER | 3 | | 3 | | | | | |
| | LECTURER | 0 | | | | | | | |
| | JUNIOR LECTURER | 0 | | | | | | | |
| | POST DOCS | 0 | | | | | | | |
| | TEMPORARY/ CONTRACT OR PART TIME | 0 | | | | | | | |
| | TECHNICIANS | 0 | | | | | | | |
| | ADMINISTRATIVE | 0 | | | | | | | |
| | RESEARCH OFFICERS | 0 | | | | | | | |
| | SENIOR SCHOLAR | 0 | | | | | | | |
| | ADJUNCT / EXTRAORDINARY | 0 | | | | | | | |
| VISITING STAFF | 0 | | | | | | | | |
| | | | | | | | | | |
| INDUSTRIAL ENGINEERING | FULL PROFESSOR | 1 | | | | | 1 | | |
| | ASSOCIATE PROFESSOR | 0 | | | | | | | |
| | EMERITUS PROFESSOR | 0 | | | | | | | |
| | SENIOR LECTURER | 1 | | 1 | | | | | |
| | LECTURER | 1 | 1 | | | | | | |
| | JUNIOR LECTURER | 0 | | | | | | | |
| | POST DOCS | 0 | | | | | | | |
| | TEMPORARY/ CONTRACT / PART TIME / OCCASIONAL | 0 | | | | | | | |
| | TECHNICIANS | 0 | | | | | | | |
| | ADMINISTRATIVE | 0 | | | | | | | |
| | RESEARCH OFFICERS | 0 | | | | | | | |
| | ADJUNCT / EXTRAORDINARY | 0 | | | | | | | |
| | VISITING STAFF | 0 | | | | | | | |

APPENDIX D

RESEARCH PROFILE: RESEARCH CENTRES, INSTITUTES, UNITS OR GROUPS

University of Cape Town

Department of Chemical Engineering

- **Centre for Bioprocess Engineering Research**

The unit, formally set up in 2001 and hosted by the Department of Chemical Engineering, has a long history of research in this field, contributing to the growth and development of biochemistry in South Africa through a national centre of expertise in bioprocess engineering. The unit maintains a productive balance between research centred on the application of biological principles through process development and on the fundamental understanding of biological processes at the mechanistic level and of the interaction of these processes with their environment. Research is built on an inter-disciplinary approach which aims to advance South Africa's developing bio-economy, contribute to the circular economy and resource efficiency while driving environmentally sustainable processes and socially responsive solutions in its transfer and application.

Website: <http://www.ceber.uct.ac.za/>

Contact: Candice Mazzolini

- **Centre for Catalysis Research**

The centre concerns itself with both fundamental and industrial research and development in the general field of heterogeneous catalysis, encompassing all of catalyst synthesis, physico-chemical characterisation and performance evaluation for industrially interesting chemical conversions. The main fields of investigation within the centre are Fischer-Tropsch synthesis, zeolite/acid catalysis, especially as applied to hydrocracking, phenols and derivatives, and catalysis by gold. The centre is the host laboratory for the DST-NRF Centre of Excellence in Catalysis in South Africa and facilitates research across multiple universities and research institutes in South Africa.

Website: <http://www.cchange.ac.za/>

Contact: Prof. Michael Claeys

- **HySA/Catalysis**

The South African government has embarked on an ambitious national hydrogen and fuel cells technologies flagship project, known as Hydrogen South Africa or HySA. The aim is to establish the country as one of the few nations that export high-value products into the growing international hydrogen and fuel cells markets. With some 80% of the world's Pt and Rh reserves, South Africa's future role is no longer exclusively as the supplier of raw materials but as a manufacturer of value-added components. HySA/Catalysis, co-hosted by the University of Cape Town and Mintek, is one of three Centres of Competence tasked with the establishment of a technical and scientific base for local contributions to the global hydrogen and fuel cell technology know-how. Its mandate includes the components in the early part of the value chain, catalysts and catalytic devices.

Website: www.hysacatalysis.uct.ac.za

Contact: Dr Sharon Blair

- **Centre for Minerals Research**

This is a multidisciplinary, interdepartmental research centre based in the Departments of Chemical, Mechanical and Electrical Engineering. The primary objectives of the centre are to investigate the research areas of flotation and comminution at both an industrial (applied) research level and at a laboratory (fundamental) research level so as to develop predictive models for describing the performance of industrial flotation and comminution units and circuits. The centre also provides high-level human resources to the South African mining industry through rigorous postgraduate research training, as well as technology transfer into operations.

Website: www.cmr.uct.ac.za

Contact: Prof. D Deglon

- **Centre for Research in Engineering Education (CREE)**

The centre promotes and develops research in engineering education to improve student learning. It is now regarded as the key player in the promotion of engineering education research and development across South Africa.

Website: www.cree.uct.ac.za

Contact: Associate Prof. Brandon Collier-Reed

- **Environment and Process Systems Unit**

The unit focuses on environmental issues of the resource-based process industries, and explores the use of process and systems engineering skills to solve environmental problems in development contexts. This includes efforts toward clean air, societies fuelled by renewable energy, clean efficient production, recycling, and a diverse biosphere protected for the future.

Website: <http://www.epse.uct.ac.za/>

Contact: Prof. Harro von Blottnitz

- **Crystallisation and Precipitation Research Unit**

A key aim of the Crystallisation and Precipitation Unit is to improve the scientific understanding of precipitation processes for scale-up, optimisation and control. The primary focus of the research is metal precipitation, a separation process used in mineral processing operations as well as for the treatment of metal containing effluent. The unit enjoys broad support from the local mineral processing industry and collaborates with international institutions in the Netherlands, Belgium, Australia and the United Kingdom.

Website: www.crystal.uct.ac.za

Contact: Prof. Alison Lewis

Civil Engineering

- **Concrete Materials & Structural Integrity Research Unit (CoMSIRU)**

This research unit has developed technologies and procedures for the design and assessment of concrete structures for more than 20 years. There is a marked focus on infrastructure performance and renewal, largely in response to industry needs. Key areas of interest include service life prediction, deterioration science, assessment technologies and repair/rehabilitation strategies for concrete structures. The unit provides consultancy and postgraduate teaching in the areas of concrete material technology, concrete durability, structural health monitoring and repair/rehabilitation.

Website: www.comsiru.uct.ac.za

Contact: Prof. Pilate Moyo

- **Centre for Transport Studies**

The centre offers postgraduate qualifications in the field of urban passenger transport planning and management. Curricula are modular and flexible in structure, enabling full-time stu-

dents and those in employment to enrol. Courses are structured on a 'block release' basis in which lectures are concentrated into one week and sandwiched between periods of self-study. It is possible to start with any course at any time of the year.

Website: www.cfts.uct.ac.za

Contact: Assoc Prof. Roger Behrens

- **Water Research Group**

The principal aim is conservation of both water quality and quantity for domestic, industrial, agricultural, recreational and ecological uses in South Africa. Through basic and applied research, the group seeks to generate solutions to water-quality problems of national importance and actively participates in the technology transfer of these solutions.

Website: www.civil.uct.ac.za/water-research-group

Contact: Prof. George Ekama

Department of Electrical Engineering

- **Digital Image Processing (DIP) Group**

DIP essentially involves how computers or machines see the world. Research currently pursued by the DIP group is multi-view 3D reconstructions and the subsequent use of these for classification and optical sensing. The group also has expertise in medical imaging and computer tomography. The group maintains a strong emphasis on industrial applications and receives funding from De Beers, Anglo Platinum, Rio Tinto, Lodox Systems, the National Research Foundation and the Department of Trade and Industry.

Website: <http://www.dip.ee.uct.ac.za/>

Contact: Associate Prof. F Nicolls

- **Advanced Machines Energy Systems (AMES) Group**

The group has developed significant expertise in the management of energy systems, grid integration of renewables, and asset management. Their previous research on motor efficiency involved the US Department of Energy, Eskom and the South African National Energy Research Institute (SANERI). Current research areas include: monitoring and fault diagnosis of machines, PM machine design, induction motor efficiency estimation, fuel cell emulators and converters, wind turbine emulation and control, grid-tied inverters for renewable energy applications, load balancing converters, etc. The research programme is funded mainly by Eskom, SANERI, THRIP and the NRF.

Website: <http://www.ee.uct.ac.za/advanced-machines-and-energy-systems>

Contact: Prof. P Barendse

- **Power Engineering Group**

Research includes power system operation and control, fault diagnosis, energy efficiency problems induced by solar weather, rural electrification, network protection and power electronics – all of which have important implications for economic and social development. The group focuses its efforts of researching ways to increase the efficiency of these systems.

Website: <http://www.ee.uct.ac.za/power-engineering>

Contact: Prof. CT Gaunt

- **RAM: Rapid Acceleration and Manoeuvrability Group**

The RAM Research Group conducts research in the field of mechatronics which aims to answer two questions: 1) What makes animals so manoeuvrable? and 2) How can we design robots which are as manoeuvrable as animals are?

Website: <http://www.mechatronics.uct.ac.za/ram-rapid-acceleration-and-manoeuvrability-group>

Contact: not listed

- Underwater Robotics Group
- Robust Control

These research groups exist within the field of mechatronics, but no further information is available regarding their research focus and activities.

- **Centre of Excellence (CoE) in Broadband Networks and Applications**

The centre is an interdisciplinary one, focusing on research into advanced networking systems with an emphasis on industry relevance and the potential for broadband-related applications and skills. The programme is sponsored by Telkom SA, Nokia Siemens Networks, Ericsson South Africa, TeleSciences, the National Research Foundation and the Department of Trade and Industry.

Website: www.Cbn.uct.ac.za

Contact: Neco Ventura

- **Spacelab**

SpaceLab is a new platform created to promote multidisciplinary education and research in space science and technology. It aims to promote the development and use of novel space technologies for use in outer space and on the Earth, and to train graduate students to strengthen the South African and African skills base in the development and applications of space systems. The laboratory will partner with local and international academic and public and private sector initiatives to realise its aims.

Website: <http://www.spacelab.uct.ac.za/>

Contact: Ulpha Ismail

Mechanical Engineering

- **Advanced Manufacturing Laboratory**

Advanced Manufacturing Laboratory has developed expertise that has assisted South African precision engineering, aerospace, tooling and automotive companies to improve their manufacturing processes. The main research focus is on high-performance machining, polishing technologies, manufacturing process optimisation, intelligent manufacturing systems and laser-processing technologies. Funding of research in the laboratory is through the National Research Foundation, Element 6, Spectra Mapal SA Pty Ltd, Okamoto Machine tool Europe GmbH, Technology Innovation Agency, National Laser Centre, Department of Science and Technology.

Website: <http://www.mecheng.uct.ac.za/aml-rk>

Contact: Not listed

- **Bioengineering**

Research in the bioengineering research group currently focuses on limb-salvage surgery and recently on implants that require complex surface development using multiple software design packages. Research emphasises improvements in the manufacturing processes for the implants and identifying new technologies, new choices of materials, treatment of articulating surfaces, as well as osseo-integration between skeletal tissue and implant. Collaboration in research and development is undertaken with academic institutions in South Africa and in India. The Medical Research Council of South Africa sponsors the research group.

Website: <http://www.mecheng.uct.ac.za/bioengineering>

Contact: Not listed

- **Radar Remote Sensing Group**

Progress in space science over the last 40 years has been rapid. Advanced satellite technology has spawned remote sensing technology, allowing observation of the earth from space using a wide range of sensors. Satellite remote sensing has become an indispensable tool in the quest to understand global ecology. This group has been operating since 1988 and is funded through contract research grants from industry and postgraduate bursaries from the NRF.

Website: <http://radarstmasters.co.za>

Contact: Prof. Mike Inggis

- **Structural Engineering and Mechanics**

This research group conducts both basic and applied research in the broad areas of structural engineering, and engages in postgraduate teaching and thesis supervision. Members participate in various scientific and technical committees at both the national and international level, provide consultancy expertise to local industry, and arrange short courses, workshops, seminars and conferences from time to time.

Website: www.structures.uct.ac.za

Contact: Prof. Alphose Zingoni

- **Blast Impact and Survivability Research Unit (BISRU)**

The unit was accredited as a formal research group in 2003, primarily driven by a request from industry to form a centre of excellence in blast protection and survivability. The stated objective of BISRU is engineering research that saves lives, especially where humans are subjected to blast and impact situations.

Website: www.bisru.uct.ac.za

Contact: Prof. G. Langdon

- **Centre for Research in Computational and Applied Mechanics (CERECAM)**

The centre concerns itself with basic research, industrial research and development, and postgraduate education in computational and applied mechanics. Its activities are multidisciplinary, involving the participation of persons qualified in a number of branches of engineering, applied mathematics and scientific computing. The research interests involve the broad field of non-linear problems in solid, structural and fluid mechanics, with a particular emphasis on the application and development of the finite element method.

Website: www.cerecam.uct.ac.za

Contact: Prof. BD Reddy

- **Centre for Materials Engineering**

The centre strives to educate and train students in techniques and fundamentals in the broad field of materials engineering. It also seeks to serve a wide range of engineering activities, giving advice concerning material processing, properties and performance whilst maintaining an international profile for its research. Research activities are aimed at addressing national needs in terms of both the provision of technological solutions and the development of skilled graduates.

Website: www.mateng.uct.ac.za

Contact: Dr Sarah George

- **Industrial Computational Fluid Dynamics Research Group (InCFD)**

The prime objective of the research group is to develop state-of-the-art computational fluid dynamics (CFD) modelling technology and expertise for the express support of industry. This is done via the pursuit of innovation through fundamental research. InCFD is home to the South African Research (SARChI) Chair in Industrial CFD.

Website: <http://www.incfid.uct.ac.za>

Contact: Prof. Arnaud Malan

- **Composite Materials Laboratory**

The laboratory initiates research on all aspects of the manufacture and processing of composite materials. The unit also makes a significant contribution to the research work carried out at the Blast Impact and Survivability Research Unit (BISRU) and the Robotics Research Unit. The work at the Composites Research Laboratory concentrates on taking commercially available raw materials and composite materials and processing these using currently known manufacturing processes to generate specialised test specimens for use in non-destructive testing research and blast impact evaluation.

Website: <http://www.mecheng.uct.ac.za/composite-materials-laboratory>

Contact: Not listed

- **Energy Research Centre**

The Energy Research Centre is the result of the merger of activities of the Energy Research Institute and the Energy Development Research Centre at the University of Cape Town. The Centre is an African-based multidisciplinary energy research centre which pursues excellence in technology, policy and sustainable development research, education and capacity building programmes at a local and international level. Staff have qualifications in engineering, natural and environmental sciences, urban and regional planning, economics, law, politics, sociology and anthropology. The multidisciplinary team conducts high quality, targeted research and offers postgraduate opportunities at Masters and PhD levels.

Website: <http://www.erc.uct.ac.za/>

Contact: Prof. Harald Winkler

- **Centre for Research in Engineering and Science Education (CREE)**

CREE is focused on establishing and promoting engineering education as a research field both at UCT and in the broader academic community. This focus has since been extended to include science and related disciplines as a need to promote education research in these areas was identified. CREE is regarded as a key player in the promotion of engineering education research and development across the whole country.

Website: <http://www.cree.uct.ac.za/>

Contact: Debby Chuter

- **Eskom Specialisation Centre for Energy Efficiency (ESCEE)**

The ESCEE aims to enhance and expand the knowledge skills and tools for process engineering practitioners. The group was established in 2012 through the Eskom Power Plant Engineering Institute (EPPEI) to create opportunities for students within Eskom and the power plant industry. The focus is to develop the skills and tools for developing numerical models which can be used to improve the efficiency of energy production.

Website: <http://www.escee.uct.ac.za/>

Contact: Priyesh Gosai

- **Non-Destructive Testing (NDT) Laboratory**

The NDT Laboratory specialises in optical interference techniques including Holographic Interferometry, Electronic Speckle Pattern Interferometry and Digital Shearography. The research and development taking place at the laboratory aims to augment the capability of industry to inspect structures non-destructively, but also to enhance the capability of establishing structural integrity through sensor monitoring techniques and associated modern technology.

Website: <http://www.ndt.uct.ac.za/>

Contact: Prof. J Gryzagoridis

- **Robotics and Agents Research (RAR) Lab**

The RAR Lab was founded in 2008. The main focus of the lab is on teaching and research in the fields of Robotics, Artificial Intelligence and Computational Intelligence. The main robots currently under development are in the fields of rescue and underwater exploration.

Website: <http://www.rarl.uct.ac.za/>

Contact: not listed

University of the Witwatersrand

Civil and Environmental Engineering

- **Construction Materials**

The main focus of this research group is in the field of cement-based and concrete materials technology. In this area, the interests range from cement clinker chemistry and crystallography to concrete durability, engineering properties of concrete and concrete testing methods. Focus is also on corrosion of steel in reinforced concrete structures. This research group has formally existed since the early 1990s and has since made significant contributions to the understanding of the behaviour of concrete under South African conditions. Much of this work is conducted under an NRF Research Programme, funded by the NRF, the cement industry and ESKOM (TESP).

Website: <https://www.wits.ac.za/ebe/schools/civil-and-environmental-engineering/research/>

Contact: Dr Mike Otieno

- **Geotechnical and Geo-environmental Engineering**

The primary areas of research for this group include the testing of piles for strength and integrity, the stability of mining residue facilities, the long-term performance of filter drains, the development of correlations to interpret in-situ tests, geothermal reservoirs modelling, underground coal gasification and Carbon capturing and storing in the subsurface.

Website: <https://www.wits.ac.za/ebe/schools/civil-and-environmental-engineering/research/>

Contact: Dr Charles MacRobert

- **Structural Engineering**

The primary areas of research for this group include experimental and analytical research into the mechanical behaviour of a wide range of structures and materials, as well as developing guidelines for use by design practitioners. The research group also specialises in structural optimisation, dynamic loading, and structural health monitoring.

Website: <https://www.wits.ac.za/ebe/schools/civil-and-environmental-engineering/research/>

Contact: Prof. M Gohnert

- **Water Research Group: Hydraulics, Water Resources and Environmental Management**

The Water Research Group (WRG) promotes intellectual discourse, training and research on water (quantity and quality) issues from an integrated perspective. The group carries out cutting-edge multidisciplinary research in hydraulics, water resources planning and management, water and wastewater reuse, flood and drought risks mitigation, rainwater harvesting, reservoir operation, efficient management of urban water systems, monitoring and management of biofilm formation in water distribution systems, polymeric ionic liquid-based membranes in wastewater treatment and remediation of wastewater using constructed wetlands. Website: <https://www.wits.ac.za/ebe/schools/civil-and-environmental-engineering/research/>
Contact: Prof. Akpofure Taigbenu

- **Infrastructure Engineering and Management**

This group focuses on the planning and implementation of infrastructure, with special emphasis on the project management principles and techniques unique to infrastructure, for example, employment-intensive methods. The broader discipline of project management is studied in the context of the southern African region, as applied to all aspects of civil and environmental engineering. Website: <https://www.wits.ac.za/ebe/schools/civil-and-environmental-engineering/research/>
Contact: Prof. Anne Fitchett

Chemical and Metallurgical Engineering

- **Waste-to-Resources Research**

Waste, in whatever form, is one of the world's largest chronic concerns. It has both public health and environmental concerns. For example, solid waste that is not properly collected and disposed can be a breeding ground for insects, vermin, and scavenging animals, and can thus transmit air- and water-borne diseases. The waste-to-resources research seeks to address the problems of waste by developing appropriate technologies for reducing, re-using, and/or recycling waste materials. Website: <https://scholar.google.co.za/citations?user=RWvzrB4AAAAAJ&hl=en>
Website: <https://www.wits.ac.za/staff/academic-a-z-listing/s/geoffreysimatewitsacza/>
Contact: Prof. Geoffrey S Simate

- **Centre in Water Research and Development (CIWaRD)**

CIWaRD supports research and development in water by embracing complexity and collaboration as the mechanism of creating novel findings and insights into the space. CIWaRD recognises four thrusts upon which it conducts its research: Water – Systems and the Environment, Water Recovery – Recycle, Re-use and Remediate, Society for Water – Citizenship and Stewardship (SW:CS) and Water - Education. Website: <https://www.wits.ac.za/ciward/>
Contact: Prof. Craig Sheridan

- **DST-NRF Centre of Excellence in Strong Materials**

The DST-NRF Centre of Excellence in Strong Materials, hosted by Wits, involves six other SA universities and two science councils. The CoE-SM was established in 2004 to provide a network for enabling researchers in strong materials to collaborate across disciplines and institutions, locally and abroad. Research is focused on carbides and cermets, ceramics, and strong metallic alloys, as well as three focus areas based in science: Carbon nanotubes and strong composites, New ultrahard materials and Diamond, hard materials, and other strong

materials. The CoE facilitates access the necessary expertise and equipment at these participating institutions. Official funding from the DST and NRF ends in 2019, and to continue the knowledge building within the scientific community, the CoE-SM is considering diversifying its research and collaborating with both local and international partners to achieve this.

Website: <https://www.wits.ac.za/strongmaterials/>

Contact: Prof. LA Cornish

- **Industrial and Mining Water Research Unit (IMWaRU)**

IMWaRU is focused on conducting relevant, high-impact research tailored to assist in solving water-based problems. Research addresses threats posed to our environment by mine drainage; water foot printing and accounting research at mine and industrial sites, delivery of novel, tailor-made research solutions for specific water issues. These include researching (1) biological passive solutions (such as constructed wetlands) tailored for conditions, (2) Physico-chemical passive solutions (such as slag leach beds for AMD treatment) and (3) Combinations of engineering & biotechnological solutions for specific effluents; and (4) Developing unique technologies for providing cheap, potable drinking water for communities lacking such.

Website: <https://www.wits.ac.za/chemmet/research/research-entities/industrial-and-mining-water-research-unit-imwaru/>

Contact: Craig Sheridan

- **Metals Extraction and Recovery Group (MERG)**

MERG activities are training and educating students and conducting basic and applied research in the field of hydrometallurgy. The intent of MERG is to develop a portfolio of high-quality fundamental research that maximise returns from processing of primary and secondary mineral resources whilst paying particular focus to the sustainability in hydrometallurgy and reduction of environmental impact across the hydrometallurgical industrial sector. Further, there is the intention to improve the performance and efficiency of hydrometallurgical/ extractive metallurgy processes through the optimisation of existing process routes and development of new, potentially transformative, technologies.

Website: www.wits.ac.za/chemmet/research/research-entities/metals-extraction-and-recovery-group-merg/

Contact: Prof. Sehliselo Ndlovu

- **Sustainable Energy and Environment Research Unit (SEERU)**

The aim of the research group is to develop expertise through research and teaching of tools for processes that are important for clean/or renewable energy production and sustainable environment. Furthermore, the research unit considers the fundamental research, and the most applied, market-oriented technological innovations within the chemical, energy and environmental sectors. It is envisaged that this approach enables both the generation of basic knowledge and provides commercialisation via small-scale innovative and environmentally sustainable technology solutions for the benefits of South African businesses and communities.

Website: www.wits.ac.za/chemmet/research/research-entities/sustainable-energy-and-environment-research-unit/

Contact: Dr Jean Mulopo

- **Bioprocess Engineering**

Bioprocess Engineering, Optimisation and Design forms a cross group research focus in the School. As such, researchers from other areas involve bio-aspects in, amongst others, Water (IMWaRU), the Environment (SEERU), hydrometallurgy (MERG) and sustainability.

Website: www.wits.ac.za/chemmet/research/research-entities/sustainable-energy-and-environment-research-unit/

Contact: Not listed

- **Tribology**

Research in the field of Tribology is focused on investigating the wear mechanisms which components experience during industrial operation, with the aim of extending the lifetime of the component and/or improving operational efficiency. Emphasis is placed on materials research and development. In recent years the major research projects have centred on cutting tool technology (cemented tungsten carbides and ceramics) and hard coatings (HVOF and Cold Spray). Minor research is also conducted on ferrous metals and other surface engineering processes. Research includes designing new compositions, producing the materials and conducting materials property and wear tests. Optimisation of the production processes used to manufacture the wear-resistant materials is also done.

Website: www.wits.ac.za/chemmet/research/research-entities/tribology/

Contact: Prof. Natasha Sacks

- **Mineral Processing Research Group (MPRG)**

The focus of this group is on the processes which take the coarse material produced by the mine, crush and mill them to appropriate sizes and separate by physical means the valuable particles from the low-grade particles. Key research areas include comminution, flotation and jigging.

Website: www.wits.ac.za/chemmet/research/research-entities/mineral-processing-research-group-mprg/

Contact: Dr Mulenga Bwalya

Electrical and Information Engineering

- **Biomedical Engineering Research Group**

Biomedical Engineering is inherently multidisciplinary, and hence the research is usually undertaken in collaboration with other research groups and in some cases with other departments and institutions. The group has been active in the fields of medical imaging, artificial intelligence and bioreactors. Some of the work has been done in collaboration with the School of Pathology and the School of Chemical and Metallurgical Engineering, as well as other research groups within the School of Electrical & Information Engineering.

Website: www.wits.ac.za/eie/research-groups/

Contact: Prof. Rubin David

- **Centre for Systems and Control**

The activities of the group range from classical control to modern linear and non-linear control. All aspects of systems and signals namely, modelling, synthesis, control analysis and design pertaining to linear and non-linear, time-invariant as well as time varying systems and signals form part of the focus.

Website: www.wits.ac.za/eie/research-groups/

Contact: Prof. Brian Wigdorowitz

- **Electric Power Research Group (EPRG)**

The High Voltage Research Programme is a long-standing research programme within the EPRG. The programme builds expert knowledge and skills in the fields of high voltage, lighting/EMC, computational electromagnetics and power system engineering. It aims to establish a sound base in research and teaching in the various associated disciplines and is committed to being a world key player in contributing expert knowledge. One of the programmes within this Research Group is the Eskom Power Plant Engineering Institute (EPPEI). The programme benefits considerably from financial support from Eskom's Tertiary Education Support Programme and other industrial partners. The EPPEI HV Centre focuses on the three

types of insulation – gaseous, liquid and solid. New developments in the design of insulation, such as the introduction of nanoparticles to improve the breakdown strength, as well as to improve the thermal properties have been made. It is also important to monitor the condition of insulation and here new monitoring and diagnostic techniques have been developed. This centre works closely with industry, as well as with Eskom through the EPPEI programme.

Website: www.wits.ac.za/eie/research-groups/research-activities/electric-power/

Contact: Prof. Ken Nixon and Prof. Cuthbert Nyamupangedengu.

- **Energy Research Group**

This group researches systems and technologies that ensure adequate secure supply of clean electrical energy into the future. Access to energy, in conjunction with access to water is one of the biggest drivers of quality of life. Given the current environmental impact issues of traditional fossil fuel based energy, expanding access to energy in this direction is not an option.

Website: www.wits.ac.za/eie/research-groups/

Contact: Prof. Willie Cronje

- **Software Engineering Research Group**

This group has a number of current research interests including: software development methodologies, smart grids, big data and bioinformatics.

Website: www.wits.ac.za/eie/research-groups/

Contact: Prof. Barry Dwolatzky

- **Telecommunications Access and Services research Group (CeTAS)**

CeTAS has a long legacy of research that has called for parts of the 'Converged' platform. To a large extent, the platform is what it is because of past research. Research in services required a distributed computing layer that used the network in an abstracted kind of way. Research on VPNs and MPLS used the network elements and the Smartbits sources to simulate a service layer throwing traffic at the network. Whilst research in radio spectrum management required new devices such as Software Defined Radios and Cognitive Radios. Running expenses for projects are covered separately by generous funding from the University Research Fund, the NRF and THRIP. However, prospective and current students are highly encouraged to seek their own funding from various funding bodies, locally and internationally.

Website: www.wits.ac.za/eie/research-groups/

Contact: Prof. Fambirai Takawira

The centre focuses on the three types of insulation – gaseous, liquid and solid. New developments in the design of insulation, such as the introduction of nanoparticles to improve the breakdown strength as well as to improve the thermal properties have been made. It is also important to monitor the condition of insulation and here new monitoring and diagnostic techniques have been developed. This Centre works closely with industry as well as with Eskom through the Eskom Power Plant Engineering Institute (EPPEI) program.

Website: www.wits.ac.za/eie/research-groups/research-activities/electric-power/

Contact: Dr John Van Coller

Mechanical, Industrial and Aeronautical Engineering

- **Wits Transnet Centre of Systems Engineering (TCSE)**

The TCSE applies systems engineering as a methodical, disciplined approach for the design, realization, technical management, operations, and retirement of a system. A system in this context is a contract or collection of different elements that together produce results not

obtainable by the elements alone. The elements or parts can include people, hardware, software, facilities, policies, and documents, that is all required to produce system-level results. This approach is used to better comprehend and manage complexities towards Transnet challenges.

Website: <http://www.tcse.org.za/>

Contact: Prof. Beatrys Lacquet

- **Transnet Matlafatšo Centre (TMC)**

The centre's aim is to stimulate entry and participation of black entrepreneurs (towards the creation of black industrialists) into innovative sectors through skills transfer and access to research and development facilities by using innovation and research to enable enterprise development; facilitating and supporting Black Economic Empowerment (B-BBEE) business activity within the space; and focusing on the development and commercialisation of social, business and technological innovations that can address market opportunities at, but not limited to, Transnet.

Website: www.wits.ac.za/tmc

Contact: Sarah Sepamla

- **National Aerospace Centre (NAC)**

The centre engages with government, industry, academia and research institutions, locally as well as internationally, in promoting sector competitiveness, applied research, and developing human capital. Additionally, the centre has a sound project management function, and enjoys international partnerships with Airbus R&T, Airbus Defence and Space (ADS), GKN Aerospace, and The Boeing Corporation, amongst others. Domestically, the NAC also works very closely with the Denel Group of Companies, Aerosud and Paramount. The NAC supports applied technology development and human capital development in a wide range of partner universities, such as the Universities of Cape Town, Stellenbosch, Pretoria, the Witwatersrand, Western Cape, Central University of Technology, and the Cape Peninsula University of Technology. In addition, the NAC works very closely with African and European country representatives such as Italy, Nigeria, Poland, Switzerland and Lithuania to foster international collaboration. Research is organised at the NAC in six thematic areas as follows; Aerospace Manufacturing Processes and Materials (AMPM); Aeronautical Dynamics & Control (AD&C), Aerospace Design Capabilities (ADCap), Firm Level Competitiveness (FLC), Space Engineering & Propulsion (SEP) and Aerospace Related Electronics (ARE).

Website: www.wits.ac.za/nac/

Contact: Philip Haupt

- **Flow Research Unit**

The Flow Research Unit conducts research into the flow of gases and liquids, with particular reference to flows that are compressible and steady or unsteady, and their interaction with bodies; with applications in aeronautics, mining, manufacturing, bioengineering, and safety. The Unit has supersonic and transonic facilities, a variety of shock tubes, including a few facilities unique in the world, rigs for the study of liquid wave phenomena and unsteady liquid flows, and access to wind tunnels. Significant numerical simulation as well as theoretical analysis is employed.

Website: www.wits.ac.za/mecheng/

Contact: Prof. Beric Skews

- **Separation Centre for Combustion Engineering**

The Separation Centre for Combustion Engineering was established in 2012 and forms part of the Eskom Power Plant Engineering Institute (EPPEI). The SCCE strives to improve the un-

derstanding of the impact of local coal and predict its effects on coal fired power plants. Research is focused on current Eskom requirements in order to improve knowledge of existing plants and create tools to design more efficient plants in the future. Therefore, the centre's aim is to grow a repository of skills and knowledge in the general area of combustion engineering related technologies. The centre is instrumental in retaining a base of highly skilled engineers in Eskom to create and maintain a healthy fleet for current and future power generation using state of the art technology.

Website: www.wits.ac.za/XXX

Contact: Prof. Walter Schmitz

Mining Engineering

• Wits Mining Institute (WMI)

The Wits Mining Institute (WMI) is a platform of long-established expertise in mining-related fields of study dedicated to inform the emergence of a 21st Century model of mining that is both sustainable and competitive. The future role of mining in the social economy depends heavily on innovation in every associated dimension, including extractive technologies, the full range of up-, side- and down-stream economic linkages, the distribution of socio-economic benefits, health and safety, the environmental externalities and post-mining economic sustainability, while also establishing an enabling environment for the industry's future. The primary focus of the WMI is the production of research of the highest quality on large multi-disciplinary and complex questions. The WMI seeks to influence the world through generating new knowledge, influencing policy, building strategic partnerships and leading society. The WMI hosts the

- The Sibanye-Stillwater Digital Mining Laboratory (DigiMine);
- The Centre for Sustainability in Mining and Industry (CSMI);
- The Joint International Research Laboratory of China-Africa Mining Geospatial Informatics;
- The Centre for Mechanised Mining Systems (CMMS)

Website: www.wits.ac.za/wmi

Contact: Fred Cawood

Details of the laboratories and/or centres hosted by WMI are described below.

The Sibanye-Stillwater Digital Mining Laboratory (DigiMine) is an exciting project where the Chamber of Mines building on West Campus was converted into a 'mine', complete with surface (using the flat roof of the building), vertical shaft (using a stairwell in the fourth quadrant of the building) and mock mine with control room in the basement. DigiMine is equipped with the digital systems that enable research for the mine of the future and is a one-of-a-kind facility with a significant research agenda to transfer surface digital technologies into the underground environment – the enabler for a mine that can (automatically) observe, evaluate and take action. The ultimate objective is to use technology to put distance between mine workers and the typical risks they are exposed to on a daily basis. DigiMine is a multidisciplinary research group that accommodates students from all faculties in the university. The impact is a world-class facility working on some world-first projects. DigiMine hosts the Sibanye-Stillwater Chair in Digital Mining and Mine Automation and with the laboratory and infrastructure at an advanced stage of implementation, its research intensity and impact are growing fast. The research agenda includes anything digital that can reduce risk, i.e. extension of surface technologies into the underground space in real time. These include systems for communication, monitoring positioning, navigation, detection of abnormalities and risk management. In short - innovation for real-time mining at reduced risk. To assist with its ambition of real-time posi-

tioning, mapping and navigation underground, DigiMine established the Joint International Research Laboratory of China-Africa Mining Geospatial Informatics.

The Joint International Research Laboratory of China-Africa Mining Geospatial Informatics is a Research partnership between the University of the Witwatersrand (Wits) and China University of Mining and Technology (CUMT) in Xuzhou, China. The collaboration, underway since January 2013, researches underground communication systems, risk measurement through sensors, risk modelling and prediction of harm – while the new initiative will focus on accurately locating workers relative to mine risks, using GPS-like underground positioning. This initiative is a step toward realizing the vision of being a world-leading laboratory with networks to mining in China and Africa, with an initial focus on mining geospatial informatics research. The joint-laboratory is currently at a university level, but has the potential to become an International Centre of Excellence doing cutting-edge and world-leading research, innovation and the development of technologies for mining and industry.

The Centre for Mechanised Mining Systems (CMMS) is as a result of the University's commitment to innovation for 21st century mining. The CMMS started business in 2006 and its research agenda includes mine modernisation, 21st century mining methods and geo-metallurgy. Within the CMMS the focus is on people and process within systems. A strong global trend has gained significant momentum in recent years, namely Surface mines are getting bigger and all mines more mechanised. Mines are embracing technology and they are well set on the path of innovation. This will lead to a future of continuous mining, where new mines will be designed for mechanisation, automation and robotics. For this reason Wits established the Centre for Mechanised Mining Systems (CMMS). Under the umbrella of the WMI the Digital Mining group and the Centre for Sustainability in Mining and Industry (CSMI) have very strong ties and links with the CMMS and there is significant synergy when it comes to attaching digital systems to machines for mine safety and efficiency.

The Centre for Sustainability in Mining and Industry (CSMI) is committed to the promotion of responsible 21st century mining. The CSMI acts as a bridge between practitioners and academia. Partners are industry, government, organised labour, communities and networks across the globe working to strengthen African mining practice. The CSMI is an independent authoritative space for dialogue and discussion of differing viewpoints. The research agenda of the CSMI includes People in Mining, Mining and the Environment and Industry and Mining. Cross-cutting themes are Policy, Regulation, Health, Safety and the Environment with a focus on Responsible Mining in Africa across the Mining Value Chain. Environmental, Community and Health and Safety management concepts have become part of the every-day mind-set of companies operating in the sector. As is the case with The CMMS the Digital Mining group has very strong ties with the CSMI as digital tools can be used to make mining more transparent by sharing quality information in real-time and allowing for stakeholder conversations having their roots in fact rather than speculation.

Focus areas are:

- **People in Mining:** The well-being of workers and communities affected by mining are central to responsible mining. Our commitment is to hear the voices of those most affected and to understand how regulation and policy can best provide protection. We work in the areas of occupational health and safety, socio-economic development in mining and artisanal and small scale mining;
- **Mining and the Environment:** Mining, throughout its life cycle, can do more to address the degradation of national resources such as water and land, the generation of waste and the potential damage to the ecosystem. Our commitment is to strengthen social and

ecological resilience through interdisciplinary innovations and policy change. We work in the areas of regional mining impacts and mine closure; and

- **Industry in Mining:** Automation and modernisation will transform mines for the future. Our commitment is to support this transition through applied research and the facilitation of dialogue between stakeholders for a sustainable mining sector.

Website: www.wits.ac.za/wmi

Contact: Fred Cawood

University of Pretoria

Chemical Engineering

- **Institute of Applied Materials (IAM)**

IAM performs applied research for industry. It pursues R&D targets in Carbon Materials and Chemical Product Design. The activities in the latter category include modelling multicomponent mixture properties, layered solids as functional additives for polymers, green pyrotechnics, and combating malaria transmission. IAM received funding support from Sasol towards the development of a long-life mosquito net (LLIN) and from the Bill & Melinda Gates Foundation for an insecticidal paint approach for indoor residual spray (IRS). IAM performs classified research on behalf of the South African Defence Force that entails the use of pyrotechnics in specialised applications. However, the main client is AEL Mining Services. The IAM is home to the research associated with the SARChI Chair in Carbon Materials and Technology and the SARChI Chair for Fluoro-materials and Process Integration.

Website: <http://www.up.ac.za/institute-of-applied-materials-iam>

Contact: Prof. Ncholu Manyala

- **Eskom Specialisation Centre in Plant Asset Management**

The Eskom Power Plant Engineering Institute (EPPEI) is an institute linked to the University of Pretoria through the Institute of Applied Materials. In 2012 Eskom established the EPPEI to produce highly skilled engineers at postgraduate level within eight broad specialisation areas at universities in South Africa. The University of Pretoria was identified for the establishment of such a specialisation centre in plant asset management. This contract was renewed in 2017 for a five-year period ending 2021. EPPEI is focused on various aspects of energy-related engineering across multiple universities:

- Emission Control – North-West University
- Energy Efficiency – University of Cape Town
- Combustion Engineering - University of the Witwatersrand
- Materials Engineering - University of Cape Town
- Plant Asset Management - University of Pretoria
- High Voltage Engineering AC - University of the Witwatersrand
- High Voltage Engineering DC - University of KwaZulu-Natal
- Renewable Energy – Stellenbosch University

Website: <http://www.eppei.co.za/>

Contact: Prof. Stephan Heyns

Civil Engineering and Industrial and Systems Engineering

- **Centre for Transport Development**

Transportation is a cross-sectoral enterprise that requires skills across a broad range of disciplines, including planning, engineering, economics, management, and social sciences. The Centre for Transport Development (CTD) provides a platform for nurturing and coordinating linkages across these various disciplines with a research focus on Optimisation, Transport Planning & Operations, Pavement Engineering and Railway Engineering. As a collaborative research entity, the CTD draws mainly on researchers and academics from the Department of Civil Engineering and the Department of Industrial and Systems Engineering, with additional specialist skills available from the Department of Town and Regional Planning and the Department of Informatics.

Website: <http://www.up.ac.za/en/centre-for-transport-development>

Contact: Prof. CJ Venter

Electrical, Electronic and Computer Engineering

- **Centre for New Energy Systems (CNES)**

Originally, the Centre for New Electricity Systems, The CNES has changed its research focus along with its name to stress its research expertise in energy systems and to continue its leading position in the field of energy optimisation, management and standardization. The thematic focus on energy management includes both the management of supply side and demand side. The cost-effective supply and end-use of energy are promoted through cooperative research within the Energy Group and Control Group of the Department of Electrical, Electronic and Computer Engineering in the University of Pretoria. The research of the centre forms an interface of energy systems, econometrics, control theory, and financial mathematics.

Website: <http://www.up.ac.za/en/centre-of-new-energy-systems-cnec>

Contact: Prof. Xiaohua Xia

- **Institute for Technological Innovation (ITI)**

The Institute performs research on the management of technology and technological innovation, technology policy and related issues. The mission of the ITI is to advance the knowledge and skills of people in terms of technological innovation and the management of technology through research, through interaction with industry, the government and other research institutes, as well as the support of training initiatives.

Website: <http://www.up.ac.za/institute-for-technological-innovation>

Contact: Prof. Anastassios Pouris

- **Centre for Excellence in Telecommunication Engineering for the Information Society (CeTEIS)**

CeTEIS was originally inaugurated in collaboration with the University of the North but is now fully located at the University of Pretoria. Main research focus areas include, but are not limited to, the Next Generation Wireless and Access Networks, xDSL Technology, Networks, Protocols and Coding (VoIP), Cloud Infrastructure and Services (Networks and Architecture). Funders are Telekom, Bytes Universal Systems, and THRIP.

Website: <http://www.up.ac.za/en/-centre-for-telecommunications-engineering->

Contact: Dr JH van Wyk

- **Research groups**

Postgraduate degree programmes are driven via the Research Groups in the Department. Each student enrolling for postgraduate studies within the Department needs to identify a postgraduate group in which to work. These groups are focused on:

- Advanced Sensor Networks (ASN)
- Bioengineering (biomedical engineering)
- Control Systems
- Electromagnetism
- Electronics and Microelectronics
- Energy Systems
- Intelligent Systems
- Power Systems
- Telecommunications and Signal Processing

Website: <http://www.up.ac.za/en/eece/article/2009367/postgraduate-research-groups>

Contact: Group contacts are listed on website noted above

- **Carl & Emily Fuchs Institute for Micro-Electronics (CEFIM)**

CEFIM is active in the field of microelectronics research and specialist training. The research and postgraduate programme is mainly in the field of integrated circuit design, especially the design of analog signal processors, RF circuits and optical receivers in CMOS technology. The simulation and modelling of circuits, devices and processing technologies are also investigated. The application of semiconductors as opto-electronic devices plays an important role in the activities at CEFIM. International contact in microelectronics is vital and CEFIM lecturers and students often participate at international conferences and overseas experts visit the CEFIM facility regularly.

Website: <http://www.up.ac.za/carl-emily-fuchs-institute-for-microelectronics-cefim>

Contact: Prof. Monuko Du Plessis

- **Centre for Electromagnetism**

Three professors in the Department of Electrical, Electronic and Computer Engineering at the University of Pretoria form the electromagnetism group in LGI. In addition to its comprehensive measurement facilities, the group has developed very strong computational abilities in various aspects of electromagnetism.

Website: <http://www.up.ac.za/en/centre-for-electromagnetism>

Contact: Prof. JW Odendaal

Materials Science and Metallurgical Engineering

- **Industrial Metals & Minerals Research Institute (IMMRI)**

The institute is funded by industrial partners to do contract research within the academic environment. The strong industrial focus, project-based approach provides leading research in especially the field of physical metallurgy, but the portfolio of the institute does include work in other fields as well.

Website: <http://www.up.ac.za/materials-science-and-metallurgical-engineering/article/48827/immri>

Contact: Dr Kevin Banks

- **Centre for Pyrometallurgy**

The key aim of this Centre is to perform internationally competitive research that is relevant to the local pyrometallurgical industry, to strengthen cooperation and support between academia and industry and to build further expertise in pyrometallurgy. The research programme within the Centre for Pyrometallurgy is strongly focused on the direct needs of South Africa.

Ongoing research is centred on ore, sinter and pellets; process thermodynamics, mechanisms, optimisation and development; reductants and fluxes; refractory materials and by-products. Modelling is the latest sub-discipline which was added as a field of focus at the beginning of 2013 through the establishment of the GlencorXstrata Chair in Pyrometallurgical Modelling.
Website:<http://www.up.ac.za/en/materials-science-and-metallurgical-engineering/article/48836/centre-for-pyrometallurgy>
Contact: Andrie Garbers-Craig

- **SAIW Centre for Welding Excellence**

The centre offers international postgraduate welding programmes in welding engineering and welding technology.

Website:www.up.ac.za/en/materials-science-and-metallurgical-engineering/article/48845/saiw-centre-for-welding-excellence

Contact: Prof. Pieter Pistorius

- **Glencore Chair in Pyrometallurgical Modelling**

The mission of the research group associated with the Chair is to make a valuable contribution to the metallurgical industry in South Africa by developing highly skilled engineers through conducting research focused on the modelling of pyrometallurgical processes. The research group has five areas of focus, namely, material property modelling, computational thermochemical analysis, process modelling, multi-physics modelling of pyrometallurgical systems, and techno-economic modelling.

Website:<http://www.up.ac.za/en/materials-science-and-metallurgical-engineering/article/2127209/glencore-chair-in-pyrometallurgical-modelling>

Contact: Dr Johan Zietsman

- **Tenova-Bateman Chair in Minerals Processing**

The Tenova-Bateman Chair in Minerals Processing was established in 2012 within the Department of Materials Science and Metallurgical Engineering.

The key aim of this Chair is to perform internationally competitive research that is relevant to the local minerals processing industry, thereby bringing the Minerals Processing Group at the University of Pretoria closer together to the minerals processing industry in South Africa.

Contact: Dr Natasia Naudé

Mining Engineering

- **Kumba Virtual Reality Centre for Mine Design**

A first for Africa, this is a world-class Virtual Reality Centre that enhances education, training and research in operational risk across industries through an innovative approach to information optimisation and visualisation. The centre was created by the Mining Engineering Department with the support of Kumba Iron Ore, a member of the Anglo American plc group. The VR Centre strives to be an innovative resource for bringing real-world scenarios to learners to enhance their exposure to their chosen industry; and allowing technical and other practitioners to simulate plans and designs in a risk-free environment with minimal time and resource allocation. There are numerous operational benefits to be gained from interpreting and portraying actual data in the high-quality and realistic visual format offered by the VR Centre.

Website: <http://www.up.ac.za/virtual-reality-centre>

Contact: Prof. Ronny Webber-Youngman

- **Mining Resilience Research Centre (MRRC)**

The aim of this initiative is to develop significant inter-disciplinary research collaboration within UP and external organisations doing research related to mining challenges. Through this multi-disciplinary network, the MRRC aims to increase the resilience of the mining industry by contributing towards practically implementable solutions to enable the mining industry, in its transition to move from being reactive and compliant, to becoming resilient in issues relating to productivity, safety, health, environment, social responsibility and community management, through well-structured and committed postgraduate education and rigorous, integrated, scientific research drive initiatives. In this, the MRRC draws on the multidisciplinary resources within UP, matching the right skillsets to any mining problem. The MRRC also aims to strengthen its national and international profile through the establishment of sound sustainable business and other collaborative relationships.

Website: <http://www.up.ac.za/en/mining-resilience-research-centre>

Contact: Prof. Francois Malan

Department of Mechanical and Aeronautical Engineering

- **Clean Energy Research Group**

CERG is involved in experimental and numerical heat transfer research focused on clean energy applications. CERG has a number of world class experimental facilities focused on heat transfer, balanced by a Computational Fluid Dynamics (CFD) division.

Website: <http://www.up.ac.za/clean-energy-research-group>

Contact: Prof. Josua Meyer

- **Centre for Asset Integrity Management**

The Centre explores a wide range of aspects pertaining to the structural integrity and performance of physical assets such as power generation equipment, petrochemical plant, water utility equipment and mining equipment. The Centre's research agenda is driven through close interactions and collaboration with industry partners. C-AIM hosts two unique postgraduate programmes in physical asset management.

Website: <http://www.up.ac.za/centre-for-asset-integrity-management>

Contact: Prof. Stephan Heyns

- **Vehicle Dynamics Group (VDG)**

The group's focus is multi-faceted and exposes scholars and students to vehicle dynamics and mobility, promotes the study and understanding of vehicle dynamics and mobility through student designs and projects in the final year mechanical engineering curriculum, 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 group encourages research activities through postgraduate studies at Masters, doctoral and postdoctoral levels and facilitates national and international collaboration with other institutions. The VDG has strong collaborative links with industry and academia on local, national and international level.

Website: <http://www.up.ac.za/vehicle-dynamics-group>

Contact: Prof. Schalk Els

- **Aerospace Group**

The CSIR and the University of Pretoria Department of Mechanical and Aeronautical Engineering, have created the first UP-CSIR Aeronautics Chair. The Group is responsible for aerospace research at postgraduate level and through academic staff in association with the Chair.

Website: <http://www.up.ac.za/aerospace-group>

Contact: Prof. Dr Lelanie Smith

- **Data Science Institute**

Data science refers to the scientific investigation that employs innovative approaches and algorithms for managing, processing, and analysing data. The University of Pretoria is well positioned to host a research institute in Big Data and Data Science, due to its existing world-class expertise in multiple disciplines, specifically, Computer Science, Statistics, Information Systems, Computer Engineering, Mathematics and Applied Mathematics, Actuarial Sciences, and Geographical Information Systems. In addition, the University has a number of internationally recognized research entities that produce masses of data to be analysed. The Institute's vision is to become a recognised world-class research, education and service delivery facility in BD and DS taking specific cognisance of the needs in South Africa, and the academic strengths of the University of Pretoria.

Contact: Prof. Andries Engelbrecht

Central University of Technology (CUT)

Faculty of Engineering

- **Centre for Rapid Prototyping and Manufacturing (CRPM)**

The CRPM was established in 1997. The centre's research focus is on medical product development through Additive Manufacturing, commonly known as 3D printing. The CRPM uses rapid prototyping, rapid manufacturing, rapid tooling and medical product development technologies to further education, understanding and development. The CRPM has recently been awarded a SACHi Chair in Medical Product Development. The Centre has an array of state-of-the-art machinery and equipment that includes the Objet Connex 350 3D printing machine that allows users to print with more than one material at a time.

Website: <http://www.crpm.co.za/>

Contact: Gerrie Booysen

Durban University of Technology (DUT)

- **Space Science Centre for Research and Postgraduate Studies**

The aim of this centre is the undertaking of research and postgraduate studies in space science for: Satellite Communications; Navigation and Surveillance (CNS); Satellite Fixed and Mobile Communications; Satellite and Platforms Space Segment and Engineering; Multipurpose GEO Spacecraft with Communications, Meteorological and Navigation (GNSS) Transponders; Satellite Earth and Meteorological Observation; Satellite GIS; Ground Segment and Infrastructures; Satellite Materials and Electronics; Satellite Asset Tracking and Fleet Management (SATFM); Satellite SCADA or M2M; Satellite Digital Video Broadcasting-Return Channel via Satellite (DVB-RCS); Satellite E-solutions; Stratospheric Platform Systems (SPS) for CNS; Airships and Aircraft; ICT and Data Processing; Intelligent Transport Systems (ITS); Augmentation of GNSS (GPS and GLONASS) Solutions; Logistics; RFID; Surface and Space Alternative Energy; other Radio and Space Technologies and Techniques for Modern Transport Systems; and additional future developments.

Website: http://www.dut.ac.za/space_science/

Contact: Prof. Dimov Stojce Ilcev

- **Centre for Water and Wastewater Technology**

The work of the centre is focused on developing and optimising technology for the treatment of water and wastewater, and green energy to satisfy the needs of industry and the community. The focus of research at IWWT is within the broad areas of water treatment, wastewater treatment and beneficiation, algal biotechnology and Biohydrogen Production.

Website: <http://www.dut.ac.za/iwwt/>

Contact: Prof. Faizal Bux

Mechanical Engineering

- **Composite Research Group**

The main stream research conducted by the group focuses on the processing, analysis and modelling of synthetic and natural composites, biocomposites, and nanocomposites. Processing of these materials are performed in-house using conventional fabrication techniques as well as high speed robotics. Mechanical and morphological analyses are accomplished via mechanical testing equipment, and, the state-of-the-art Thermal Analysis and Scanning Electron Microscope laboratories located at DUT. The behaviour of these advanced materials are modelled using finite element packages and other computational software. The research group is also beginning to work in the field of Mechatronics through the Mechatronics Laboratory located at DUT. This research stream includes PLC programming, logic circuits, automation, robotics, new and novel end-effectors, and various control strategies. As mentioned above, there are studies involving composite processing and high-speed robotics.

Website: <http://www.dut.ac.za/cam/>

Contact: Prof. K Kanny

North-West University

Faculty of Engineering

- **Unit for Energy and Technology Systems (UETS)**

UETS strives to be recognised as a centre of expertise for research in and development of energy and technology systems that are relevant to society, the environment and the country. The Unit addresses national strategic goals and contemporary issues through engineering solutions that meet industry needs, while maintaining a balance between basic and applied research. Research is largely carried out through faculty-supported focus groups. Many of these groups are primarily concentrated on Energy Systems, i.e. three SARCHI Chairs in (1) Nuclear Energy, (2) Biofuels and Other Clean Alternative Fuels and (3) Coal Research as well as the Hydrogen Energy-hosted entity and other faculty-supported focus groups such as Thermal Fluid-Systems, Energy Management and Smart Power Systems, Intelligent Systems, Telecommunications and ICT (Telenet), Dynamic modelling and control of large scale Industrial Systems (McTronX), Aircraft Development, Advanced Manufacturing, Industrial Engineering and Water Research. Close ties with key industry role players such as Sasol, Eskom, Denel Aviation, Telkom and SAPPI, as well as with the main research funding bodies are used to fund research and maintain industry relevance.

Website: <http://www.nwu.ac.za/research-support/research-entities>

Contact: Prof. FB Waanders

- **Centre of Excellence in Carbon-Based Fuels**

The Centre of Excellence in C-based fuels was proposed in 2016 and formally constituted in 2018 with an aim to focus on the continued research into clean coal processes, biomass to fuels and chemical processes, as well as the development of mitigation technologies to manage the carbon footprint and to improve and extend the interaction between Chemical Engineering, Chemistry, Microbiology, Agriculture and Environmental sciences at the NWU to include all aspects of this energy field from the coal beneficiation process to the development of commercially attractive production processes and products to the benefit of the country as a whole.

The Centre of Excellence will thus strengthen the NWU's position as research institution in the energy field. This will be accomplished through continued research outputs of high quality as well as development of commercially attractive (through patents and prototypes) produc-

tion processes and products. The Centre will be the host for the present three established research Chairs, i.e. (1) SARChI Chair in Coal Research, (2) NRF Research Chair in Biofuels and in association with the ESKOM EPPEI Chair in Emissions Control, and (3) and will enlarge its footprint into environmental aspects and underground coal gasification.

Website: www.engineering.nwu.ac.za/research/research

Contact: Prof. FB Waanders

- **Aircraft Development Group**

The aircraft development group focuses on aerodynamic and structural research that could improve the performance and safety of sailplanes and light aircraft. The technology gained from the research is then directly implemented in new designs which have great commercial value. The group also focuses on new technologies for manufacturing of these aircraft in order to improve quality and to reduce manufacturing costs. These sailplanes are sought-after by some of the best pilots around the world in order to compete internationally in gliding championships. Final year engineering students as well as postgraduate students working in the group, experience a high technology, commercialised environment which further prepares them for a career in the industry. The group's industry partners are Jonker Sailplanes and On Track Technologies.

Website: <http://engineering.nwu.ac.za/research/aircraft-development>

Contact: Dr Johan Bosman

- **SARChI Chair in Biofuels and other Clean Alternative Fuels**

The Biofuels Research Group is active in the field of second and third generation bio-refinery research, covering both biochemical and thermochemical production routes. The group consists of a unique blend of microbiologists, chemical engineers, biochemists and chemists, enabling the use of a diverse set of skills and knowledge in the research applications. The group is actively working with industry partners that will implement the developed research towards lowering production costs, increasing revenue and lowering overall emissions and effluents from the production plants. Some of the groups' research on ultrasonic irradiation has been implemented in industrial paper mills.

Website: <http://engineering.nwu.ac.za/research/bio-energy>

Contact: Prof. Sanette Marx

- **Centre of Research and Continued Engineering Development (CRCED)**

This Centre focuses on energy management and bioengineering research. Energy management research includes industrial energy simulation, optimisation, and systems development. The bioengineering research focuses on metabolic or energy-related conditions such as cancer, diabetes and coronary heart disease. Partnerships exist between CRCED and ESKOM (Energy Efficiency), ECSA (commitment and undertaking to facilitate the practical training of new engineering graduates) and, internationally, Principia Mathematica Inc (Simulation).

Website: <http://engineering.nwu.ac.za/research/centre-research-and-continued-engineering-development-crced>

Contact: no name listed, 10728023@nwu.ac.za

- **SARChI Research Chair: Coal Research**

The Group undertakes research focusing on fine coal processing, coal utilisation optimization, and waste utilization with the quest to explore new horizons for coal utilisation. The group's portfolio is strongly focused on technology with a good balance of fundamental and applied research.

Website: <http://engineering.nwu.ac.za/research/coal-group>

Contact: Prof. John Bunt

- **Energy Research Group (ERG)**

The ERG is a multi-disciplinary research group that conducts cutting edge research and offers research opportunities at Bachelors (final year), Masters, PhD and postdoctoral levels. The research done by ERG is always focused on providing ground-breaking solutions to improve energy efficiency and energy management on both national and global levels. Research foci include performing energy efficiency, energy management and energy engineering in the following fields of electrical machines, power electronics and control engineering. International partners: include the University of New Orleans, USA, the American University of Iraq, Iraq and the University of Warwick, UK.

Website: <http://engineering.nwu.ac.za/research/energy-group>

Contact: Prof. Rupert Gouws

- **DST HySA Infrastructure Centre of Competence**

Funded by DST, the Centre of Competence is co-hosted by NWU and CSIR, and is focused on developing cost-competitive solutions for generating hydrogen using renewable energy and other chemical carriers as well as for hydrogen storage and distribution. Key facilities of HySA Infrastructure continue to develop state-of the-art hydrogen production technologies that have the capacity to supply hydrogen on-site and on-demand for both stationary and non-stationary applications.

Website: www.hysainfrastructure.org/

Contact: Dr Dmitri Bessarabov

- **Intelligent Systems Research Group**

This group investigates problems of a practical nature that are typically characterised by complex operations reflected by large data sets that should be mined to discover currently unknown relationships inherent to these systems. The group performs work in the fields of road transportation, cross-border trade corridors, security installations, mining operations, security documents, sound and video recognition and others. In all cases practical problems are addressed as identified by industry partners. These partners include WTO, SANRAL, SAAF, RTMS, FESARTA, Digidcore, Imperial Logistics, Techsolutions, EW Cop, Fidelity, Security, and INET-BFS.

Website: <http://engineering.nwu.ac.za/research/intelligent-systems>

Contact: Prof. Alwyn Hoffman

- **McTronX**

The core activity of the McTronX research group is the Dynamic Modelling and Control of large-scale industrial systems or processes. Characteristic of the group is the multi-disciplinary nature of its projects. The research group was founded in 2003 due to the research needs of the Pebble Bed Modular Reactor (PBMR) project under way in South Africa at the time. Industrial partners include Sasol, Denel Aviation, Omnia, Multotec, and Proconics.

Website: <http://engineering.nwu.ac.za/research/mctronx>

Contact: Prof. George van Schoor

- Telenet Research Group

- The research done by the Telenet group is broadly within the area of Information and Communication Technology Telenet Research Group

(ICT), with specific projects focusing on telecommunications, data networks, information security, and associated applications. The Telenet research group manages a dedicated research laboratory, named the Shannon laboratory. This laboratory houses the Cisco Academy and specialised telecommunications research equipment, computers and experimental

systems. The Telenet group is actively involved with industrial partners such as Telkom, Yrless and other THRIP program partners. The Telenet group mainly receives funding from Telkom via the Telkom Centres for Excellence initiative.

Website: <http://engineering.nwu.ac.za/research/telenet>

Contact: Prof. Albert Helberg

- **Thermal-fluid Research Group**

This group focuses on research relevant to the thermal-fluid industry with the emphasis on energy systems. The thermal-fluid research group are involved with, but not limited to the development of thermal-fluid research test facilities; the development of the next generation of CO₂ heat pump technology; integrated solar water heating with heat pumps; application of numerical modelling techniques for the simulation of energy systems, optimisation and control, through mathematical modelling of thermal flow systems for industry and the use of biomass for electricity generation. Industry partners include M-Tech Industrial Pty (Ltd), Eskom via M-Tech Industrial, Korea Atomic Energy Research Institute (KAERI), Sasol and One Green Engineering CC.

Website: <http://engineering.nwu.ac.za/research/thermal-fluids>

Contact: Prof. Martin van Eldik

Mechanical Engineering

- **Materials, Vibrations Analysis and Manufacturing Research Group**

This research group specialises in materials selection for design, ceramics, and wear resistant ceramic matrix composite processing, high temperature nuclear materials, metals and materials coating processing, material integrity and failure analysis, vibration mitigation and vibration analysis.

Website: <http://engineering.nwu.ac.za/research/materials-vibrations-analysis-and-manufacturing>

Contact: Prof. Johan Markgraaff

University of Johannesburg

Faculty of Engineering and the Built Environment

- Research groups listed on website but no further information available:
- Industrial Electronics Technology Research Group
- Telecommunications Research Group
- Stream Processing Research
- Metal Casting Technology Station

- **Process, Energy and Environmental Technology Station (PEETS)**

PEETS was established in 2010 and receives funds from TIA. They aim to develop technological innovations that support the energy and environment sectors. The primary mandate for the PEETS is to contribute towards improving the competitiveness of industry through the application of specialised knowledge, technology and facilitating the interaction between industry (especially SMEs) and academia in order to enable innovation.

Website: www.uj.ac.za/research/Pages/centres.aspx

Contact: not listed online

- **TechnoLab**

The Technolab exposes young people to technology, making them aware of the roles of technology, entrepreneurship and innovation in South Africa's economy and promotes technology in community programmes.

Website: www.uj.ac.za/faculties/febe/technoLab/Pages/default.aspx
Contact: Estelle Momberg

Department of Mechanical Engineering Science

Research Groups listed by title and with a contact, but no further information available:

- Aviation Research Group: Dr A Maneschijn
- Composite Research Group: Dr A Maneschijn
- Engineering Education Research Group: Mrs N Janse van Rensburg
- Modern & Advanced Manufacturing Research Group: Prof. E T Akinlabi
- Solar & Renewable Energy Research Group: Mr M Bhamjee

University of KwaZulu-Natal

Agricultural Engineering

Research groups listed on website but no further information available:

- Hydrology Focus Group (HFG)
- Bioresources Engineering Focus Group (BEFG)

- **Ukulinga Research Farm**

The Ukulinga Research and Training Farm houses a workshop, computer-controlled engine test bay and control room, as well as a soil and water laboratory. Since its inception, the 400-hectare farm situated near the campus, has been the site of unique and ground-breaking research in several agricultural disciplines, including bioresources engineering. It is used extensively as an "outdoor laboratory" for research and the training of students and also includes a sustainable small-scale farming section. The farm features active facilities for agricultural research, including poultry, dairy, swine, grasslands, and field crop (irrigated and dryland) agriculture.

Website: <http://bioeng.ukzn.ac.za/research/ukulinga-research-farm>

Contact: Prof. JC Smithers

- **Energy, Food and Water Engineering (EFWE) Research Group**

The group contributes to the development of engineering and science research in three main areas: energy and supply chains in biomass production and processing systems; irrigation, soil & water engineering; food process and postharvest engineering. Within these research areas the fundamental elements of engineering are combined with a range of other disciplines, such as hydrology, soil, animal, food and crop sciences.

Website: <http://efwe.ukzn.ac.za/>

Contact: Prof. JC Smithers

Civil Engineering

- **The Centre for Research in Environmental, Coastal and Hydrological Engineering (CRECHE)**

CRECHE aims to be an internationally recognised centre of excellence for applied research in the fields of Environmental, Coastal and Hydrological Engineering, and to develop, disseminate and apply state-of-the-art knowledge for solving environmental problems. Creche is made up of the following research units:

1 Environmental Engineering Group

In 2007 CRECHE-Enviro launched the ZETA research portfolio that focuses on zero waste, energy recovery, treatment of landfill emissions and awareness through education. This research portfolio is supported by local government, the World Bank and NRF. Current research in environmental engineering includes the following areas: waste management; landfill emissions control, management and treatment; leachate/biogas characterisation and treatment; waste-to-energy and carbon emissions reduction; zero waste; waste water treatment and land remediation; metals removal using permeable reactive barriers constructed wetlands; denitrification using organic substrates as a carbon source.

Website: <http://civeng.ukzn.ac.za/Research.aspx>

Contact: Prof. Cristina Trois

2 Estuary and Coastal Research Group

Current research includes the following areas: Computational fluid dynamics; estuary hydrodynamics (e.g. St. Lucia estuary); coastal water quality monitoring and pollution dispersion modeling; as well as coastal engineering: wind, waves and cross-current modeling, sediment transport. The multi-disciplinary research on estuaries is supported by WRC, WWF, NRF and is conducted in collaboration with an estuarine research group in the School of Biological & Conservation Sciences at UKZN.

Website: <http://civeng.ukzn.ac.za/Research.aspx>

Contact: Prof. Derek Stretch

3 Satellite Applications and Hydrology Group (SAHG)

The SAHG focuses on research relating to the use of remote sensing data in Hydrology. The group has worked (often in collaboration with the SA Weather Service) on stochastic modelling of radar rainfall fields, stochastic nowcasting of rainfall fields measured by radar and satellite, combining satellite, radar and gauge data to yield the 'best' daily rainfall fields over southern Africa, catchment modelling for flood forecasting, and exploring the feasibility of remote sensing of soil moisture in the region. SAHG currently participates in international and national contracts to achieve these ends.

Website: <http://sahg.ukzn.ac.za/>

Contact: Prof. Geoff Pegram

• Infrastructure Research Group (IRG)

Funded by the eThekweni Chair, the IRG is currently doing research on the rehabilitation of pipe networks in collaboration with the Metro and Umgeni Water, and on the carbon impacts of an urban bus rapid transport systems (Ms Elena Friedrich). Current research topics focus on structures include reliability of structures, in particular reinforced concrete. Links have also been established with Stellenbosch University. The research is supported by WRC and the eThekweni Chair and is contributing to the development of the proposed new SANS 10100-3 (The design of reinforced concrete water retaining structures).

<http://civeng.ukzn.ac.za/Research.aspx>

Contact: Prof. Derek Stretch

• The Transport Research Group

Research is being done in the following areas: Researching the re-use of construction and demolition material, and recycled asphalt in warm mix asphalt (WMA); concrete durability in road structures, as well as, in investigating the potential and advantages of replacing traffic

signals with circles. This research group collaborates with eThekweni Roads and Traffic Authority and SANRAL with occasional funding from ECoTD.

Website: <http://civeng.ukzn.ac.za/Research.aspx>

Contact: Prof. Everitt

- **Structural Engineering & Computational Mechanics (SECM) Group**

Initiated in 2016, SECM focuses on the development of methods, applied to several types of structures and materials. Group research interests are focused on problems related to non-smooth contact mechanics, composite materials, masonry structures, concrete structures, multi-scale formulations and homogenisation, xfm methods, steel structures and thermo-mechanical analyses, topology optimisation approaches, design of cracks in concrete structures, deterministic and probabilistic approaches for the study of water retaining structures.

Website: <http://secm.ukzn.ac.za/Homepage.aspx>

Contact: Dr Georgios A Drosopoulos

Electrical, Electronic & Computer Engineering

- **Centre for Radio Access and Rural Technologies (CRART)**

Listed but no further information available online.

- **High Voltage Direct Current (HVDC)**

The Eskom Centre of Excellence (CoE) in High Voltage Direct Current (HVDC) Engineering also serves as the Eskom Power Plant Engineering Institute (EPPEI). The CoE is a multi-disciplinary research centre which focuses on research in technology relating to HVDC, power systems (including lines) and power electronics relating to AC systems. The broad HVDC research themes include: long distance transmission and the provision of telecommunications; external insulation; Corona and field effects; performance of lines and systems in Southern Africa; exploitation of VSC and HVDC cable technology and innovation.

Website: <http://hvdc.ukzn.ac.za/Homepage.aspx>

Contact: Prof. Dave Dorrell

Mechanical Engineering

- **Solar Car Project**

The UKZN Solar Team has been designing and building solar cars since 2012 when a group of mechanical engineering students and two academics at UKZN's School of Engineering built a solar-powered vehicle for the Sasol Solar Challenge.

Website: <http://solarcar.ukzn.ac.za>

Contact: Clinton Bemont

- **Touch Prosthetics**

Touch Prosthetics is a spin-off of the University of KwaZulu-Natal. Touch Prosthetics seeks to drive the prosthetics field forward and make the technology more accessible to the general public. This will be achieved through the production of low-cost, modular advanced prosthetics with the aid of advanced 3D printing.

Website: <http://touchprosthetics.com>

Contact: Drew van der Riet

- **Vibration Research & Testing Centre (VRTC)**

The Vibration Research & Testing Centre (VRTC) is the first established building on the Science & Technology Innovation Park. It was launched in December 2000 through collaboration with Eskom and the Department of Trade and Industry through the Technology Human Resources

and Industry Programme (THRIP), as well as Eskom's Tertiary Education Support Programme (TESP). A R6.8 million investment resulted in a world-class facility which consists of a 95-metre long temperature regulated laboratory. The laboratory is one of only four in the world and it is the only facility of its kind in the Southern Hemisphere. The VRTC provides the basis for the performance of high-level applied research that addresses the key issues relating to the operation of overhead transmission and distribution lines (conductors, clamps and other equipment). It is an ideal facility to carry out strategic research on mathematical and experimental modeling of overhead transmission and distribution lines relating to wind-induced aeolian vibrations.

Website: <http://vrtc.ukzn.ac.za/Homepage.aspx>

Contact: Mr P Moodley

- **Aerospace Systems Research Group (ASReG)**

ASReG conducts applied research in rocket propulsion and associated technologies such as thermal management and launch systems. ASReG has two overall aims: to develop aerospace technologies related to rockets and space vehicles; and to develop human skills in aerospace engineering.

There are various sub groups within ASReG:

1 Hybrid Rocket Propulsion

Hybrid rockets are propelled by a combination of solid fuel and liquid oxidiser and offer advantages over solid motors, such as improved safety and the capacity for throttling. ASReG's hybrid propulsion work takes place under the Phoenix Hybrid Sounding Rocket Programme (HSRP). This aims to develop a series of flight vehicles leading to the deployment of a 100 km apogee sounding rocket for use by the African physics community. Hybrid research focuses on the design, testing and integration of various rocket sub-systems, including vehicle airframes, motors, avionics and launch facilities. The group's current focus is on enhancing motor performance through the introduction of metal fuel additives to paraffin fuel.

2 Liquid Rocket Propulsion

The liquid propulsion research programme focuses on component design for high-performance turbopumps. This work will lead to the complete design of ASReG's South African First Integrated Rocket Engine – SAFFIRE – which comprises a small-scale booster engine capable of powering a small-satellite launch vehicle to low Earth orbit.

3 Thermal Management

Managing the onboard energy budget of a spacecraft requires the ability to transfer heat from where it is generated (source) to where it can be radiated away (sink). Two novel heat transfer systems have been investigated by ASReG, namely loop heat pipes and pulse thermal loops. The thermal management research also has application in terrestrial systems such as high-performance electronics. The development of a high-flux solar furnace by UKZN's Group for Solar Energy Thermodynamics (GSET) offers new opportunities for conducting high temperature experimental work related to ablatives, in-space solar concentrators and materials research.

4 Launch Systems

ASReG's work in propulsion requires that we build and test launch systems capable of supporting hybrid rocket campaigns. The group's mobile launch platform is configured to enable static test-firing of medium-scale hybrid motors as well as providing an erectable gantry for vehicle launches. The platform can be towed to launch sites on public roads and incorpo-

rates a LabVIEW controlled propellant handling system to fuel hybrid rockets remotely.

Website: <http://aerospace.ukzn.ac.za/>

Contact: Dr Michael Brooks

- **Mechatronics and Robotics Research Group (MR2G)/MR2G Bioengineering Unit**

The MR2G Bio-Engineering Unit applies its engineering capabilities for biomedical research and technology development. By integrating expertise in electronics, artificial intelligence, micromachining and material technologies with biological and medical sciences, the MR2G Bioengineering Unit conducts research on the design and development of robots and devices that will assist disabled people and surgeons. The different requirements that are needed for these devices are investigated which involve video transmission, communication and control for each device's unique capabilities. The types of devices that are being researched are medical practitioner's aiding devices; disabled people's support devices and bio-mechatronics devices.

Website: <http://mecheng.ukzn.ac.za/Research/MR2Gbioengineeringunit.aspx>

Contact: Prof. Glen Bright

Chemical Engineering

- **Thermodynamics Research Unit**

The Thermodynamics Research Unit is a top-rated research group in this area in the world with collaborations in Germany, France, Poland, Sweden, UK, among others. Much of the research carried out is industry linked with projects being run for SASOL, Nuclear Energy Corporation of South Africa (Necsa) and other industries requiring research support in chemical separations. The SARChI Chair also covers research in reactor technology and organic synthesis.

Website: <http://thermodynamics.ukzn.ac.za/>

Contact: Prof. Deresh Ramjugernath

- **Pollution Research Group**

The Pollution Research Group is an informal group of researchers within Chemical Engineering that undertake contract research. The primary industrial research partners are eThekweni Municipality Water and Wastewater Services, Bill and Melinda Gates Foundation, Sasol Technology Pty (Ltd), Water Research Commission and National Research Foundation and focuses on wastewater and sanitation

Website: <http://prg.ukzn.ac.za/>

Contact: Prof. Chris Buckley

- **Fluidisation Technology and Clean Coal Technologies**

The research is focused on combustion, gasification and pyrolysis, fluidised bed hydrodynamics, and industrial applications. Funding is provided by ESKOM and NRF.

No website available.

Contact: Prof. M Carsky

- **Process Control**

Current research concerns modelling, identification and control of hybrid systems, with applications on water distribution networks and multiple-effect evaporators.

No website available.

Contact: Prof. M Mulholland

- **Corrosion of Materials of Construction**

Provides consultancy to private companies and individuals, and works on own corrosion topics for publication purposes. All work is related to corrosion of materials of construction (metals

and plastics) and most projects are in collaboration with Mangosuthu University of Technology.

No website available.

Contact: Mr C Baah

- **Fibre-Processing Research Group**

The FPRG is a unit of the CSIR's Forest and Forest Products (FFP) Research Group with specialisation in the fields of wood chemistry and wood morphology, pulping, bleaching, low and high consistency refining, recycled fibres and non-wood pulping and bleaching. Other areas of research include optimisation of the use of recycled fibres for maximum yield and optimal paper or tissue properties; Water closure in recycled paper mills; New pulping, delignification and bleaching technologies for fibre yield improvements and reduction in environmental impacts; Cleaner production in the pulp and paper industry; Pulp mills as biorefineries (extracting value-added products from wood prior to processing into pulp and paper). Research activities in this area include valorisation of lignin, production of biodiesel and bio-oils, ionic liquids, extraction of high value chemicals, and valorisation of mill sludge.

No website available.

Contact: Mr I Kerr

- **Minerals Processing Research Group**

Research mostly sponsored by industry (Lonmin Platinum and Anglo Platinum) and Mintek. Recent projects included various aspects of platinum flotation and pebble grinding. Some work has also been done on leaching, and a new project has been started on leaching of manganese ore and production of manganese dioxide.

No website available.

Contact: Prof. BK Loveday

- **CFL Project**

The compact fluorescent lamps (CFL) have been introduced all over the world. Their life span is limited. At present there is no known technology of processing of spent bulbs. It is not possible simply to dump them as a solid waste or to treat them as ordinary glass. This is because they contain valuable Yttrium and Europium. Another reason for further processing of spent bulbs is their content of highly toxic Mercury. We have developed and patented a new technology of recovery of these two precious metals from spent CFL's together with toxic waste processing. The construction of a commercial unit is about to be completed.

No website available.

Contact: Prof. D Ramjugernath

- **Reactor Technology**

This research group is focused on the following main areas:

- Design, optimisation and modelling of multiphase chemical reactors and mass contactors
- Chemical reaction engineering, kinetics and catalysis
- Fluid and particle dynamics
- Development and optimisation of processes for the synthesis of fluorochemicals
- Investigation of a novel direct coal to liquids solvent mediated process
- Chemicals from catalytic upgrading of sugarcane bagasse pyrolysis oil
- Bagasse fractionation using high pressure hot water treatment

No website available.

Contact: Dr D Lokhat

Cape Peninsula University of Technology (CPUT)

- **South African Renewable Energy Technology Centre (SARETEC)**

SARETEC is the first national centre for renewable energy training and education in South Africa. SARETEC expedites specialised industry-related and accredited training for the entire renewable energy (RE) industry including short courses and workshops. The Centre has received funding from the Department of Higher Education and Training (DHET) through the National Skills Fund (NSF) and substantial support from the German Ministry for Economic Cooperation and Development through the South African-German energy programme (SAGEN), implemented by the GIZ, the South African National Energy Development Institute (SANEDI) and Green Cape.

Website: <https://www.saretec.org.za/>

Contact: Dr Naim Rassool, Email: rassooln@cput.ac.za

- **Flow Process Research Centre (FPRC)**

The mission of the group is to contribute to advances in the science of rheology by applying the fundamental principles and techniques of rheology to industrial problems, such as flow under different process, shear and material structure conditions. Research areas range from mining slurries and paste & thickened tailings, to explosive emulsions, foodstuffs, pharmaceuticals, flowable concrete and cosmetics. Industrial partners include, AEL Mining Services, IHS-ESDU (UK), PPC, and Fresenius Kabi (Germany).

Website: <http://www.cput.ac.za/academic/faculties/engineering/research/fprc>

Contact: Prof. Irina Masalova, Email: masalovai@cput.ac.za

- **F'SATI**

CPUT hosts the region's premier nano-satellite programme, which has developed Africa's first nano-satellite, ZACUBE-1, and is currently developing what will be the most advanced South African CubeSat to date, ZACUBE-2. The Programme is hosted by the French South African Institute of Technology and the African Space Innovation Centre. The programme is strategically aligned with the National Space Strategy, and is funded as a key human resource development programme by DST and the NRF.

Website: <http://www.cput.ac.za/blogs/fsati/>

Contact: Prof. Robert van Zyl, Email: vanzyl@cput.ac.za

- **Quantum Physics Research Group**

This group investigates and develop expertise in quantum based technologies, such as quantum communications, quantum computing and investigate more fundamental issues related to cold atoms and Bose-Einstein Condensates. A laboratory is being developed for the purposes of laser cooling of atoms, and subsequent development of quantum information processing components. The group has collaborative links with researchers at the University of Stellenbosch, iThemba labs, and the National Metrology Institute of South Africa (NMISA).

Website: www.cput.ac.za/academic/faculties/engineering/research/quantum_physics

Contact: Dr Kessie Govender, Email: govenderk@cput.ac.za

- **Centre for Substation Automation and Energy Management Systems (CSAEMS)**

The recently launched Centre is the only one of its kind in South Africa and offers specialised training, research and development in new technologies, which will improve power systems in South Africa. The centre, equipped with a state of the art substation automation laboratory, will provide students with hands-on experience and will provide much needed training for engineers and technicians already employed in industry.

Website: www.cput.ac.za/academic/faculties/engineering/research/135-faculties-and-short-courses/faculty-of-engineering/engineering-faculty/5184-centre-for-substation-automation-and-energy-management-systems-csaems

Contact: Prof. R Tzoneva; Email: tzonevar@cput.ac.za

- **Centre for Distributed Power and Electronic Systems (CDPES)**

Power electronics and drives are used in diverse sectors, ranging from industrial to residential applications. The centre aims to develop power conversions for renewable energy sources and investigate interconnectivity of distributed resources with microgrids and electric power systems. CDPES research areas thus include energy efficiency, renewable and alternative energy technology, distributed energy system technology, predictive control of power converters and electrical drives and MEMS energy sensor technology. CDPES uses networked sensor technology, ubiquitous computing, ambient intelligence, and associated electronic communication systems developments as part of their applied research focus.

Website: <http://www.cput.ac.za/academic/faculties/engineering/research/135-faculties-and-short-courses/faculty-of-engineering/engineering-faculty/5187-centre-for-distributed-power-a-electronic-systems-cdpes>

Contact: Prof. Tariq Kahn; Email: khant@cput.ac.za

- **Centre for Real-Time Distributed Systems (CRTDS)**

The research investigations of the Centre concentrate on contributions to the theory and practice of Real-Time Distributed Systems (RTDS) in application areas such as biotechnological processes (wastewater treatment and fermentation), networked control systems, standard based substation automation, and optimization of complex systems.

Website: <http://www.cput.ac.za/academic/faculties/engineering/research/135-faculties-and-short-courses/faculty-of-engineering/engineering-faculty/5185-centre-for-real-time-distributed-systems-crtids>

Contact: Prof. R Tzoneva; Email: tzonevar@cput.ac.za

- **TIA Adaptronics Advanced Manufacturing Technology Laboratory**

Adaptronics is the technology that integrates sensor and actuator functions into materials, components and structures so that they may react to environment stimuli thus making them intelligent. The TIA Adaptronics Advanced Manufacturing Technology Laboratory (Adaptronics AMTL) was established in 2007. The primary objective of the unit is to specialise as a national manufacturing, research and educational resource centre for Adaptronic Technologies in South Africa. The unit's partnerships include variety of Large Companies, SMME's, Regional and National Government Departments, South African Research Facilities, as well as other Universities.

Website: <http://www.cput.ac.za/academic/faculties/engineering/research/amtl>

Contact: Prof. Oscar Philander; Email: philandero@cput.ac.za

- **Technology Station: Agrifood Technology Station**

The ATS is a platform that provides a range of interdisciplinary technological services to the agrifood sector, focusing on existing smaller and medium enterprises, with a view to improving competitiveness, innovation, and research and development capacity in a sustainable manner. It is funded by the TIA, an initiative of the DST. ATS is located on the Bellville campus, and includes a pilot plant with various processing areas, general and cold stores, and a number of laboratories.

Contact: Mr L Dolley; Email: dolleyl@cput.ac.za

- **Technology Station: Clothing and Textiles**

Provide support to the clothing and textile industry to improve innovation and competitiveness. The Technology Station in Clothing and Textiles (TSCT) is located in the Faculty of Engineering at Cape Peninsula University of Technology, Bellville Campus. The TSCT was established to provide innovation support to the clothing and textile and related industry to become more competitive.

The following range of specific services is provided to the clothing, textiles and related sectors:

- Manufacturing Advisory Services
- Technology support centre: Specialized machines available for use by SMMEs
- Product analysis and testing - Woolworths Correlated lab
- Human capital development: Short learning programmes
- Product development: Pattern Development, Pattern grading

W: <http://www.tsct.co.za>

FB: <https://www.facebook.com/TSCT.CPUT>

Contact: Mr S Isaacs; Email: techstation@cput.ac.za

- **Crystal Engineering**

The unit conducts research in the field of crystalline solids. The main focus is on understanding molecular recognition in the solid state. Current projects involve the study of inclusion compounds and other multicomponent systems. Chiral resolution via diastereomeric salt formation is an important area of research whereby left- and right-handed molecules are separated due to solubility differences of the salts. Another area of research is in pharmaceutical co-crystals and salts. These new solid forms can improve the physicochemical properties of a drug such as solubility and bioavailability. Host-guest chemistry and Werner complexes are employed in the selective enclathration of various guests. The intermolecular interactions in the crystal structures of these compounds are investigated and can be related to the thermal behaviour and where applicable, the selectivity profiles of target molecules.

Contact: Prof. A Jacobs; Email: jacobsa@cput.ac.za

Stellenbosch University

Civil Engineering

- **Unit for Construction Materials**

UCM aims to lead teaching, research and consulting in the arena of construction materials in South Africa. The research focus of the Unit is eco-friendly construction materials; fibre reinforced concrete; fresh and young concrete; and high performance concrete.

Website: <http://www.sun.ac.za/english/faculty/eng/ucm>

Contact: Prof. Billy Boshoff

- **Institute for Water and Environmental Engineering (IWEEUSU)**

IWEEUSU specialises in research and specialised consulting in the fields of river hydraulics and sedimentation, eco-hydraulics, coastal engineering, water resources management and water services. IWEEUSU is endowed with an excellent and spacious hydraulic laboratory for use by academic, undergraduate and postgraduate researchers for physical model studies. Mathematical modelling is also undertaken.

Website: <http://civeng.sun.ac.za/research/water-and-environmental-engineering/>

Contact: Prof. HE Jacobs

- **Institute of Structural Engineering (ISE)**

Research and specialist consultation is conducted through the Institute. The ISE undertakes advanced research and development in various fields of structural engineering, including the

application of information technology in civil engineering. The Institute also offers specialist consultation services to industry. In addition to commissioned research, industry is provided the opportunity to support academic research and to support training of specialists in the post-graduate programs. The ISE manages several current research programmes including the following:

- Centre for Development of Steel Structures (CDSS) performs testing of full-scale structures and sub-structures, including dynamic measurements and numerical modelling
- The Centre for Development of Sustainable Infrastructure (CDSI) performs research on concrete, concrete materials, computational mechanics, structural engineering informatics, and structural reliability.

Website: <http://civeng.sun.ac.za/research/structural-engineering-civil-engineering-informatics>

Contact: Dr C Barnardo

- **Institute for Integrated Transport Technology**

The IGIT serves as a regional centre for research and development projects in transportation and mobilises the necessary expertise for the execution of these projects. The Institute conducts research and supports ongoing learning through professional training programmes. Activities are undertaken through close co-operation between the Departments of Civil Engineering and Transport Economics. All aspects of transport are covered with emphasis on: Pavements, Economics, Safety, Energy, Risk, Construction and Information.

Website: <http://civeng.sun.ac.za/research/geotechnical-and-transport-engineering/>

Contact: Director: Prof. Christo Bester

Electrical and Electronic Engineering

- **Electrical Machines Laboratory (EMLab)**

The EMLab undertakes research, design and development of both conventional and special electrical machines, applied magnetics and power electronics. EMLab researchers have been working on a series of design and development projects, including: Battery powered EVs Transverse flux machine, High speed PM generator SRM machine drive, IPM traction motor drive Novel PM hub motor, Advanced motion control and Gearless wind generators.

Website: <http://research.ee.sun.ac.za/emr/index>

Contact: Prof. Maarten J Kamper

- **Power Electronics Group**

This lab does research mainly for industry and governmental organisations. Clients include Eskom and SANERI.

Website: <http://www.ee.sun.ac.za/research/electrical-energy-systems/>

Contact: Not listed online

- **Superconductivity, Advanced materials and NanoDevices (SAND)**

This research group is focused on superconductive digital circuits (including software defined radio front-ends), superconductive IC parameter extraction (inductance), superconductive analogue sensors, SQUID magnetometry, cryocooled electronic interfaces, EDA software development and geomagnetism.

Website: <http://www.ee.sun.ac.za/research/electronics-electromagnetics/>

Contact: Prof. CJ Fourie

- **Electronic Systems laboratory (ESL)**

ESL has participated in the development of satellites in the past (SUNSAT, South Africa's first operational space satellite) but is currently specializing in research and technology develop-

ment relating to the automation of air, space, terrestrial and underwater vehicles. Typical activities include the support of PhD- and Master-level graduate study and the development of technology demonstrators and advanced vehicle demonstrators for industry partners. Industry partners for funding and collaborative research projects include, Airbus, CSIR, Spaceteq, SANSA, Surrey Space centre, Institute for Maritime Technology and ARMSCOR.

Website: <http://www.esl.sun.ac.za/>

Contact: Mr Arno Barnard

- **Digital Signal Processing Group**

The group has many areas of particular focus and research targeting signal processing of various kinds. These include speech recognition, image processing, broadcasting, network protocols, under-water communication and software defined radio. The group includes academics and postgraduate researchers.

Website: <http://www.dsp.sun.ac.za/>

Contact: Dr Herman Engelbrecht

- **Software Defined Radio (SDR) Research Group**

The SDR Research Group is a group of postgraduate engineering students of Stellenbosch University. The group focuses on the development of a software library for use in SDR-related projects, with an object-oriented architecture to facilitate fast and flexible application design.

Website: http://research.ee.sun.ac.za/sdr/wiki/index.php/Main_Page

Contact: Dr Gert-Jan van Rooyen

Mechanical and Mechatronic Engineering

- **Biomedical Engineering Research Group (BERG)**

BERG was established in 2005 as a result of growing interest from industry and students alike in this exciting field. The group has a very close association with the Department of Industrial Engineering and Department of Electrical and Electronic Engineering, as well as the Faculty of Health Sciences. BERG projects are mainly funded by industry partners and often supplemented with government grants. The Group works in a variety of areas, including biosignal processing; hardware and software design of devices and systems used to measure biological signals (instrumentation, sensors, and measurement); biomechanics; information technology in biomedicine; robotics in surgery; telemedicine (sometimes called "telehealth" or "e-health"); sport technology, and biological microelectromechanical systems (MEMS) such as microrobots or tiny devices for implants.

Website: <https://www.the-berg-us.com/>

Contact: Dr Cobus Müller

- **Centre for Renewable and Sustainable Energy Studies (CRSES)**

CRSES acts as a central point of entry into Stellenbosch University for the general field of renewable energy. Some contract research projects are completed within CRSES while others end up in the other academic departments or research entities of the university. Research is focused on solar thermal energy, wind, ocean and bio-energy as renewable sources which need to be optimised.

Website: <http://www.crses.sun.ac.za/>

Contact: Prof. Sampson Mamphweli

- **Solar Thermal Energy Research Group (STERG)**

STERG was formally constituted in 2010 and is currently funded by Sasol, the Department of Science and Technology and the Department of Trade and Industry (via the THRIP programme). This research group, together with the Department of Mechanical and Aeronautical at the

University of Pretoria, forms the Solar Thermal Energy Spoke. STERG is also collaborating with the Mechanical Engineering Department at the University of KwaZulu-Natal, which has an active group working on solar resource measurement and characterisation. STERG is affiliated with the Centre for Renewable and Sustainable Energy Studies, the national academic hub for renewable and sustainable energy. Primary funders are DST/NRF and Eskom. The Group takes a multidisciplinary approach to solar thermal research, including research areas such as CSP system concepts, development & analysis; thermal energy storage; heliostat and overall collector R&D; Linear Fresnel collector R&D; Stirling dish R&D and the application of solar heat in industry.

Website: <http://sterg.sun.ac.za/>

Contact: Prof. Johan van der Spuy

- **Sound and Vibration Research Group (SVRG)**

The SVRG has established expertise, equipment and laboratory facilities to conduct research and investigations into noise and vibration problems for industry as well as the public sector. The group's primary field of research is associated with human response to sound and vibration where, in particular, seating dynamics and sound quality are investigated.

Website: <http://www.svrg.sun.ac.za/>

Contact: Dr Annie Bekker

- **Mechatronics, Automation and Design Research Group**

The group focuses on product design and manufacturing systems that combine controllers, sensors, actuators and/or mechanisms, such as reconfigurable manufacturing systems and metrology-systems.

Website: www.academic.sun.ac.za/mad/

Contact: Prof. Anton H Basson

- **Materials Engineering Group**

The Group focuses on developing numerical-experimental techniques to obtain an understanding of material behaviour for modelling and predictive capabilities. Research activities are aimed at addressing national needs within the context of providing technological solutions and the development of skilled graduates at a postgraduate level. Projects are directed at an understanding of the relationships between structure, properties and performance of engineering materials. Additional research areas include linking manufacturing processes to material performance; developing material models for predictive capabilities; and material characterisation and analysis.

Website: <http://www0.sun.ac.za/mateng/>

Contact: Dr Thorsten Becker

Process (Chemical) Engineering

- **Bioresource Engineering Group**

The group's research therefore revolves around the use of biological resources in the development of production processes, and can be subdivided into two classes: processes that employ biological resources (e.g. live organisms like yeasts or bacteria, or active biological molecules like enzymes) to transform raw materials into valuable products, or production processes that use biological raw materials as inputs. There is a strong interdisciplinary focus within the group, and frequent collaboration occurs with other disciplines at Stellenbosch University and with leading foreign institutions.

Website: <http://process.sun.ac.za/research/bioresource-engineering/>

Contact: Dr Annie Chimphango

- **Extractive Metallurgy Group**

Important research areas in extractive metallurgy undertaken by this group include: hydro-metallurgy, pyrometallurgy, physical processing, surface chemistry, flowsheet design, and monitoring for abnormal events, process control and economic optimisation.

Website: <http://process.sun.ac.za/research/extractive-metallurgy/>

Contact: Prof. Guven Akdogan

- **Separations Technology Group**

This research group focuses on understanding the underlying fundamentals of thermal separation processes involving various hydrocarbons. Main research thrusts include:

- High/supercritical and low pressure phase equilibria measurement (VLE, LLE and VLLE) and thermodynamic modelling of these complex systems
- Hydrodynamic characterisation of tray and packed columns
- Supercritical fluid extraction and/or fractionation of high molecular mass compounds

Website: <http://process.sun.ac.za/research/separations-technology/>

Contact: Prof. André Burger

- **Waste Valorisation Group**

There are three main research thrusts in the Waste Valorisation group:

1. Waste tyre conversion to high-value chemicals (REDISA project)
2. Electronic waste processing for metal recovery (lithium, gold, copper)
3. Biological waste utilisation (e.g. wastewater, agricultural residues, fishery waste, etc.)

Website: <http://process.sun.ac.za/research/waste-valorisation/>

Contact: Prof. Guven Akdogan

- **Water Technology Group**

The Group focuses on research and development aimed at addressing current local and international challenges in water treatment and provision. Its key objective is to improve existing water treatment technologies, as well as develop new technologies that will contribute to addressing this global challenge. Group strengths lie in membrane technology for water treatment and reuse (microfiltration, ultrafiltration, reverse osmosis, forward osmosis, membrane distillation and Donnan Dialysis), and in technologies that will be applicable and sustainable in developing economies. Current projects range from investigation and modelling of basic phenomena, to technology development leading to implementation in the field.

Website: <http://process.sun.ac.za/research/water/>

Contact: Prof. André Burger

Nelson Mandela University (NMU)

Faculty of Engineering and the Built Environment

- **Technology Research Activity Centre (TRAC), Eastern Cape Centre**

TRAC is involved in education intervention programmes, where the main aim is to uplift the standard of Physical Science education in South Africa. This is done with educator training programmes, vocational guidance assistance, as well as classroom intervention in schools where the resources are limited or lacking. By doing so, TRAC is true to its mission to enable and encourage South African school leavers to enter careers in Science, Engineering and Technology. TRAC is instrumental in redressing not only educational problems, but also industrial shortages.

Website: <http://ebeit.mandela.ac.za/Faculty-Entities-and-Projects/Entities>

Contact: no contact listed online

- **eNtsa**

eNtsa is a research, design and technology support centre for the manufacturing sector. This is achieved through provision of research supporting new technology development, technology support for optimising existing production processes and infrastructure and advancing the high-end skills level by offering technical training according to international best practices. eNtsa provides support for enterprises in the first, second and emerging economy within the engineering and manufacturing sector, with a specific focus on the automotive component sector. The Technology Station is actively involved with testing, contract research, industrial design and development and the transfer of knowledge.

Website: www.entsa.nmmu.ac.za

Contact: Prof. Daniel Hattingh

- **Friction Processing Research Unit (FPRU)**

This Institute identifies and serves the needs of the international/national friction processing community by contributing to sustainable development through research, technology development and continuing human resource development. Within the field of friction processing the Unit has a focus on process optimisation, modelling and material characterisation; and to develop and optimise innovative friction processing techniques.

Website: www.fpri.nmmu.ac.za

Contact: Prof. Danie Hattingh

- **Advanced Mechatronics Technology Centre (AMTC)**

AMTC is a non-research entity focusing on growing human resources development in the field of engineering. This include the Siemens accredited training facility, the FESTO accredited training facility, the Automotive Experiential Career Development Programme (AECDP), the Starting Blocks community outreach project, and the AIDC HRD programme which includes the advancement of black engineers, technicians and technologists.

Website: www.amtc.nmmu.ac.za

Contact: Mr Karl du Preez

- **Ford Engine Research Unit (FERU)**

Ford Motor Company of Southern Africa entered into a partnership with NMU to create an engine research unit with the focus on achieving a higher level of expertise, innovation and competitiveness in the automotive industry. The FERU will centre its activities on new engine research and development trends, new initiatives within the field of engine testing and associated research, and facilitating the transfer of knowledge into teaching and learning concepts for both undergraduate and postgraduate engineering programmes.

Website: <http://ebeit.mandela.ac.za/Faculty-Entities-and-Projects/Entities>

Contact: No contact listed online

Mangosuthu University of Technology (MUT)

- **Centre for Algal Biotechnology**

The Centre for Algal Biotechnology (CAB) – a first for South Africa and one of a few internationally that focuses on integrating microalgal research with commercial industries – is responsible for providing research infrastructure and supervision for postgraduate students from UKZN and DUT. The aims of the centre are:

- To identify indigenous species of microalgae that produces a commercially valuable product.
- To optimise the cellular production of the value added biological compound.
- To determine the economic feasibility of commercialising the value added product.

- To collaborate with biotechnology industries to setup commercial incubators.
- To collaborate with national and international researchers in the area of algal biotechnology and ecology.
- To produce recognised research outputs.

Website: <https://www.mut.ac.za/centres-units/>

Contact: Not listed online

Vaal University of Technology (VUT)

Faculty of Engineering and Technology

- **Centre for Alternative Energy**

Alternative energy research focuses on:

- The development of fuel cells and fuel cell membranes
- Hydrogen generation and storage
- Sustainable electricity for rural communities through solar, wind and fuel cell energy

Website: <https://www.vut-research.ac.za/alternative-energy/>

Contact: Prof. Christo Pienaar

Chemical Engineering

- **Centre for Renewable Energy and Water (CREW)**

CREW aims to be leading global centre for renewable energy and water research creating innovative knowledge. Focus areas for CREW include:

- Renewable energy production (biodiesel, biogas and bioethanol)
- Application of adsorption technique in point-of-use potable water purification and in wastewater remediation
- Storm water management and hydrology
- Biological wastewater treatment and environmental pollution control
- Advanced oxidation processes (semi-conductor based heterogeneous photocatalysis and Photo-Fenton)
- Application of computational fluid dynamics (CFD) technique in reactor optimization
- Application of nano-materials in pollution management

Website: <https://www.vut-research.ac.za/renewable-energy-and-water/>

Contact: Prof. Ochieng Aoyi

Tshwane University of Technology (TUT)

Faculty of Engineering and the Built Environment

- **Centre for Energy and Electric Power (CEEP)**

The CEEP conducts cutting-edge research in energy and electric power, and provides training, services and state-of-the-art technological solutions for industrial, commercial and domestic applications for sustainable development.

Website: www.tut.ac.za/citsis/engineering/ceep/

Contact: Dr Olawale Popoola

- **French South African Institute of Technology Institute (F'SATIi)**

The Institute located at TUT is a national asset contributing to the creation of knowledge and prosperity and the transfer of technology in the Southern African Region by establishing collaboration with other higher education and research institutes. The Institute aims to offer education, research and innovation, sustain a technology incubation centre facility, support

South African entrepreneurs, sustain research and offering qualifications at Masters and Doctorate level.

Website: www.tut.ac.za/citsis/engineering/fsati/

Contact: Prof. Anish Kurien

- **Institute for Advanced Tooling**

IAT is focused on applied research in tool design, high speed manufacturing and reverse engineering both locally and internationally. The Institute aims to advance the competitiveness of South African manufacturing SMMEs through the provision of advanced manufacturing technology and to provide consulting services in high value manufacturing.

Website: www.tut.ac.za/citsis/engineering/iat

Contact: Mr Mkatheko Makhubela

- **Institute for Nanoengineering Research (INR)**

INR is a multidisciplinary research institute which focuses on technological innovations in the emerging fields of nanoscience, nanotechnology and nano engineering and their impacts on social-economic development and the environment. The Institute also provides training that addresses the needs of the Mechanical Engineering Department and relevant industrial partners.

Website: www.tut.ac.za/citsis/engineering/inr/

Contact: Prof. Sadiku Rotimi

- **Technology Station in Chemicals**

TIA Technology Station in Chemicals is a programme initiated by DST with a mandate to transfer chemical technology to SMMEs.

Website: www.tut.ac.za/citsis/engineering/tsc

Contact: Ms Reitumetse Khabeng

- **Technology Station in Electronics**

The Technology Station in Electronics is focused on concept development, electronic product development and prototyping and small scale electronic manufacturing services.

Website: www.tut.ac.za/citsis/engineering/tse/

Contact: Mr Kobus Vorster

- **The South African Manufacturing Technology Demonstration Centre**

The South African Manufacturing Technology Demonstration Centre was established on 1 April 2008 as a non-profit company. The focus of the Centre in the incubation of mixed manufacturing and green sector technologies is to:

- Accelerate the creation and development of small manufacturing enterprises.
- Facilitate and foster self-employment opportunities among aspiring entrepreneurs.
- Integrate business, manufacturing and servicing aspects through hands-on training and development on working projects for numerous potential entrepreneurs in Gauteng and the Western Cape.

Website: www.tut.ac.za/citsis/engineering/amtdc

Contact: Mr Cornelius Scheepers

Unisa

- **Centre for Software Engineering (CENSE)**

CENSE offers short learning programmes (SLPs) in Computer Science, Information Systems and Information Technology. The purpose of the SLPs is to reflect Unisa's commitment to enhance

learning opportunities in the non-formal curriculum, thereby enhancing people's competencies, without having to enrol for comprehensive degree qualifications.

Website: <http://cs-cert.unisa.ac.za/>

Contact: censel@unisa.ac.za, no name provided online

- **Nanotechnology and Water Sustainability Research Unit**

The NanoWS research unit has identified five focus areas of research under which various strategic projects relating to nanotechnology and water research are developed. These are membrane research; composites, nanocomposites and nanomaterials for water purification; analytical/environmental research; urban water cycle and rural community development; and bioremediation and analysis.

Website: <http://www.unisa.ac.za/sites/corporate/default/Colleges/Science,-Engineering-&Technology/Research/Nanotechnology-and-Water-Sustainability>

Contact: Dr Leute de Kock

- **Institute for the Development of Energy for African Sustainability (IDEAS)**

IDEAS offers expertise in the area of process synthesis to optimise existing processes, or in conceptual designs of new processes. Focus areas include the field of coal/natural gas/biomass/waste to liquid fuel processes via Fischer-Tropsch technologies (XTL), Fischer-Tropsch Catalysis, Separation Systems Design, Reactor System Design (Attainable Regions); Biochemical Processes / Biotechnology, and Comminution.

Website: <http://www.unisa.ac.za/sites/corporate/default/Colleges/Science,-Engineering-&Technology/Research/>

Contact: Prof. Diane Hildebrandt

- **Material and Process Synthesis Research Group (MaPS)**

MaPS specialises in novel techniques for designing chemical processes with an emphasis on reducing material and energy consumption as well carbon dioxide emissions. MaPS provides access for industry to cutting edge techniques developed in the academic arena. These solutions range from short term consulting services through to medium or long-term outcome focused research and development partnerships.

Website: <http://www.unisa.ac.za/sites/corporate/default/Colleges/Science,-Engineering-&Technology/Research/Material-and-Process-Synthesis>

Contact: Prof. Diane Hildebrandt

APPENDIX E

RESEARCH CHAIRS AT HIGHER EDUCATION INSTITUTIONS

Nelson Mandela University (NMU)

- **merSETA Chair for Engineering Development**

The purpose of this Chair is to grow human resources in electrical, industrial and mechanical engineering, as well as mechatronics in order to enhance the manufacturing industry in the Eastern Cape to enable competitiveness and a growing and sustainable economy. The objectives are to increase capacity at FET Colleges; promote women in engineering; create an awareness of the relevance and importance of engineering at schools within rural communities in the Eastern Cape Province; increase capacity of educators at technical high schools in the Eastern Cape Province; and develop specialist training courses to address the needs of the manufacturing industry.

Website: mersetachair.nmmu.ac.za

- **General Motors South Africa (GMSA) Chair in Mechatronics**

The purpose of the Chair is to assist in the establishment of new R&D trends, opportunities and initiatives within the field of mechatronics. It facilitates knowledge transfer into teaching and learning concepts and integrates it into undergraduate and postgraduate engineering programmes. It further seeks to strengthen international opportunities and cooperation between NMU, other national and international institutes of learning and the automotive industry.

Website: gmsamechatronics.nmmu.ac.za

- **Volkswagen South Africa-German Academic Exchange Service (VWSA-DAAD) International Chair in Automotive Engineering**

NMU aims to facilitate increased innovation and international competitiveness of the integrated Motor Manufacturing Industry (MMI) in the Eastern Cape and to provide appropriate human resource development that will ensure an adequate number of high-level trained specialists in engineering with leading edge expertise. The focus is on materials and manufacturing technology and processes to enhance technology transfer opportunities from the university mainly into the small and medium enterprise (SME) automotive component supplier sector.

Website: vwsadaad.nmmu.ac.za

University of Pretoria

- **Harmony Gold Chair in Rock Engineering and Numerical Modelling – Prof. J Hanekom**

Established in 2015, the Chair has created a vehicle that assists the South African industry to continue research in rock engineering, and especially the use of numerical modelling techniques within the field. Ultimately this Chair will be able to serve the whole mining industry and evaluate substantially more rock engineering issues than originally intended.

Website: <http://www.up.ac.za/en/mining-engineering/article/2454220/speakoutup>

- **Transnet Freight Rail Chair in Railway Engineering – Prof. H Gräbe**

The Chair in Railway Engineering in the Department of Civil Engineering at the University of Pretoria was established in 1996 when Spoornet (now Transnet freight rail) initiated a partnership between industry and the university. This partnership revolves around three major aspects: graduate training, continuing education courses for industry and railway research.

Website: <http://www.up.ac.za/chair-in-railway-engineering>

- **Glencore Chair in Pyrometallurgical Modelling – Dr Johan Zietsman**

The Glencore Chair in Pyrometallurgical modelling was established in 2012 and started operating in February 2013. The first students started their projects in 2014. It is led by Dr Johan Zietsman, and other staff members include Dr Robert Cromarty. There are currently 12 students (2 undergraduate, 7 Masters, and 3 PhDs) working in on a variety of research projects. The research group has five areas of focus

- Material property modelling
- Computational thermochemical analysis
- Process modelling
- Multiphysics modelling of pyrometallurgical systems
- Techno-economic modelling

The approach of the research group is to enrol students from different backgrounds (metallurgical, chemical, mechanical, etc.). Finding ways to collaborate with other institutions is also an important goal of the group. Another key approach of the research group is to use open source software where possible. This allows for a lot of freedom in research settings, and students also learn more when using open source software compared to commercial software.

- **Eskom Chair in Plant Asset Management – Prof. Johann Wannenburg**

In 2012, Eskom established the Eskom Power Plant Engineering Institute (EPPEI) to produce highly skilled engineers at postgraduate level within eight broad specialisation areas at universities in South Africa. The University of Pretoria was identified for the establishment of such a specialisation centre in plant asset management. This contract was renewed in 2017 for a five year period ending 2021.

Website: <http://www.eppei.co.za/>

- **Sentech Chair in Broadband Wireless Multimedia Communication – Prof. Sunil Maharaj**

The SENTECH Chair in Broadband Wireless Multimedia Communications (BWMC) participates in state-of-the-art research activities in the field of Wireless Broadband Multimedia Communications. It delivers world-class research and educational outputs for the benefit of SENTECH, the University and South Africa in general.

Website: <http://www.up.ac.za/sentech-chair-in-broadband-wireless-multimedia-communication/home>

- **Exxaro Chair in Energy Efficiency – Prof. Xiaohua Xia**

This Chair was established in June 2012 with the industry support of Exxaro. It is hosted by the Centre of New Energy Systems. The mission of this Chair is to participate in forefront research activities in the field of energy efficiency and to deliver world-class research and educational outputs for the benefits of Exxaro, the University of Pretoria, and South Africa in general. This Chair is specifically devoted to addressing energy-efficiency problems of industrial processes by modelling, optimisation, control and management techniques. The Chair also aims to train suitably qualified engineers to solve practical engineering problems and work for the industry.

- **WEIR Minerals and Exxaro Chair in Maintenance Engineering – Prof. Stephan Heyns**

The recently established Chair in Maintenance Engineering in the Centre for Asset Integrity Management (C-AIM) in the Department of Mechanical and Aeronautical Engineering at UP, has received strong funding support from Weir Minerals Africa, a company that delivers engineering solutions to customers in the minerals, oil and gas, and power markets. This support will enhance the masters and PhD research programs offered by the Centre, with special emphasis on condition monitoring and mechatronics systems. The support from Weir Minerals is further testimony of the relevance of the Centre to industry, as other prominent companies such as Exxaro, Eskom and Rand Water have also committed funding support for the next five years.

There is a rapidly growing need to optimally manage the integrity of physical assets over their entire life cycle. Engineering assets, a term that usually refers to physical assets such as machinery used in production processes, have acquired strategic and sensitive business and social roles in modern socio-economic, political and technological settings, a fact which has led to these assets increasingly being used past their original design lives in lieu of growing safety and environmental concerns and continuous financial pressure. Trends like these require an in-depth understanding of all aspects of the asset management process and gives rise to a need for a new generation of engineers and scientists to be educated with a proper understanding of the asset life cycle and the interdisciplinary nature of this process.

UP's Centre for Asset Integrity Management (C-AIM) explores a wide range of aspects pertaining to the structural integrity and performance of physical assets such as power generation equipment, petrochemical plant, water utility and mining equipment. The Centre is considered to be unique in that it integrates its analysis and testing capability in assessing the structural integrity and performance of physical assets, with sound scientific research to inform asset management decisions.

- **Anglo-American Chair in Pyrometallurgy – Prof. Andri Garbers-Craig**

The Centre was established in 2009 when Anglo American established the Anglo American Chair in Pyrometallurgy. With the establishment of this Chair, the company stipulated that its main purpose would be to address the shortage of academic resources, maintain quality tertiary tuition in pyrometallurgy, and meet core-teaching outcomes specified by the Engineering Council of South Africa (ECSA). As part of the conditions of the establishment of the Chair, Anglo American suggested the establishment of a Centre for Pyrometallurgy supported by industry and government. The Centre for Pyrometallurgy in the Department of Materials Science and Metallurgical Engineering therefore became a reality on 30 May 2011. The key aim of this Centre is to bring the Pyrometallurgy Group at the University of Pretoria and the South African pyrometallurgical industry closer together. It aims to strengthen communication, cooperation and support between academia and industry, and to further develop expertise in pyrometallurgy. Other objectives include the delivery of high-quality manpower in pyrometallurgy and the execution of internationally competitive applied research of interest to UP's industry partners

- **AEL Mining Service Chair in Innovate Rock breaking technology – Prof. William Spiteri**

The AEL Mining Services Chair in Innovative Rock breaking Technology will reside within the Faculty of Engineering, Built Environment and Information Technology, in the Department of Mining Engineering at the University of Pretoria. The department has established a solid reputation in the South African mining industry with its ability to produce high calibre graduates, supply additional training to meet the industry's needs, conduct relevant research and be a

source of specialist information in all aspects of mining operations. To maintain the capabilities of such a centre of excellence, it is imperative that staff, postgraduate students and industry co-workers are continuously involved in practical, relevant and groundbreaking research in the mining field. The Chair's key objective is to increase AEL's exposure within the university, with specific reference to developing future leaders in the mining industry.

AEL, a member of the JSE-listed AECI Group in South Africa, has been a leading developer, producer and supplier of commercial explosives, initiating systems and blasting services for mining, quarrying and construction markets in Africa and select international markets such as Latin America, Europe, the Middle East and Asia Pacific. AEL collaborates with customers through its value proposition named IntelliBlast™. IntelliBlast™, is the culmination of over 100 years' experience and offers a holistic and flexible approach to help clients on their unique journey to optimal blast outcomes using AEL's suite of differentiated products and services. In addition to supplying indispensable products, the company has also provided know-how, training and consultation in the complex but crucial process of blasting rock in underground mines as well as on surface operations. Throughout the decades, AEL has endeavored to ensure that South African blasting practices have kept pace with new developments internationally. It is within this spirit that the AEL Chair in Innovative Rock breaking Technology has been established at the University of Pretoria.

The initial pilot project under the auspices of the newly established Chair will be the "Determination of Safe Blast Clearance Radii for Blasting". This lead project will pave the way for future investigations and eventually entrench a successful and symbiotic relationship between AEL and the University of Pretoria.

- **Sasol Chair in Safety, Health and the Environment – Prof. Jan du Plessis**

The Chairholder for the Sasol Chair is Prof. Jan du Plessis. It was expected that through the Sasol Chair in Safety, Health and environment that further research opportunities within the coal mining environment will materialise. The current low oil price and the associated coal prices have suppressed the research activities and initiatives within the coal mining industry. A number of engagements with individual coal companies have mostly led to a free-advice service, but this will change again in the near future when energy prices recover. Research in noise reduction and the impact on noise induced hearing loss (NIHL) continued in 2014 and 2015 and has led to further investment by the MHSC in additional equipment through a research based seed fund. Further initiatives in this area will have to include industry partners. Dust management and suppression within the surface as well as the underground environment formed part of the research activities in the department in 2015. This will continue into 2016, and the announcement of the new Mine Health and Safety Council Milestones will form the support base for future studies. Sasol has not made any further support available, outside the previous committed support.

- **Rand Water Chair in Civil Engineering – Prof. Fanie Van Vuuren**

This research Chair was established in the Department of Civil Engineering in 2014, and is engaged in research on determining a change in the hydraulic capacity of pipelines. This research, under the leadership of Prof. Fanie van Vuuren, examined the elements to be considered in the hydraulic design of pipelines. The research team considered the recorded hydraulic performance of pipelines, secondary energy loss associated with the dimensional details of the couplings, the adaption of the friction formula to include the influence of biofilm growth, and the provision of monitoring points for the continuous or intermittent hydraulic assessment of the pipeline. The research found it to be imperative that a periodic review of the hydraulic

performance of conveyance systems be undertaken, which would be simplified if the design of water systems included sufficient access points on the system to measure flow and pressure.

- **Rand Water Chair in Mechanical Engineering – Prof. Nico Theron**

The Chair was established in 2014 and focuses strongly on the development of asset integrity analysis and management techniques for water distribution. Pipe integrity forms a large part of this activity.

- **Sedibeng Water Chair in Water Utilisation Engineering – Prof. Evans Chirwa**

This research Chair, with Prof. Evans Chirwa as Chairholder, will focus on the delivery of high-quality water, and follows an integrated approach to total water management via ongoing participation in research activities and promoting consumer awareness of the value of water. The Department's broad objectives are to promote research in the South African water sector and the training of water engineers. The focus is on controlling the growth of algae, odour-causing and toxic organic compounds and the optimisation of chlorine doses to meet demand. The research Chair's first round of funding will last for five years with an annual budget of R1.4 million. The funding will be used to build capacity and support research in the remediation of algal infestation and the impact of eutrophication on natural water bodies. The research will focus on controlling algal growth, determining carbon cycling and improving the treatability of algal metabolites in the interim.

- **South African Council of Shopping Centres Chair – Prof. Chris Cloete**

"A partnership between the South African Council of Shopping Centres (SACSC) and the Department of Construction Economics in the Faculty of Engineering, Built Environment and Information Technology at the University of Pretoria has resulted in the founding of a Chair in Shopping Centre Studies. This is the first Chair of its kind in South Africa, and will be headed by Prof. Chris Cloete. The partnership is a ground-breaking and innovative display of leadership by the SACSC, and is an expression of its commitment to empowerment, equity and transformation opportunities."

- **Chair in Electronic Defence Research (CEDR) – Prof. Warren du Plessis**

The Chair in Electronic Defence Research (CEDR) was established in collaboration with the Council for Scientific and Industrial Research (CSIR). The mission statement of the CEDR was agreed to be: *"The mission of the CEDR is to perform research and innovate at the forefront in the field of ED, to source and supervise postgraduate students in this research field, to produce research papers for international journals and conference proceedings, to create IP to the benefit of the people of South Africa."* While this mission is written with South Africa in mind, the global nature of modern research means that it is impossible to achieve the stated objectives without strong international relationships and collaborations.

For the purposes of the CEDR, electronic warfare (EW) – and equivalently ED – is defined as: *"EW deals with the exploitation of the EMS to the maximum benefit of oneself and ones allies, and to the maximum detriment of ones adversaries."*

While short, this definition highlights the following issues:

- EW deals predominantly with actions in the electromagnetic spectrum (EMS).
- This definition highlights the fact that EW is relevant to other fields such as radar, communications, optics, cyber, etc.
- Possible non-military applications are included by avoiding the use of the term "enemies."

Almost every technology which falls within the fields of "Electrical, Electronic and Computer Engineering" is relevant to EW, so EW offers an extremely broad range of research opportuni-

ties. Furthermore, the way in which widely-differing technologies are integrated in EW makes it an ideal basis for learning more about the engineering fields listed above. Even students with no fundamental interest in EW are thus encouraged to consider postgraduate studies in EW as a way to access a unique opportunity to strengthen their skills as engineers.

- **Chair in Maintenance Engineering – Prof. Stephan Heyns**

This Chair was established in 2009 and has enabled the centre to considerably expand its capacity (teaching and research) in the area of maintenance engineering. Numerous industry related projects are in process.

- **SAIW Centre for Welding Management – Prof. Pieter Pistorius**

South Africa is currently experiencing a severe shortage of qualified Welding Engineers, engineers in other disciplines with sufficient welding knowledge and experience and Welding Technologists. Engineers are generally in short supply in South Africa, and most of the engineers and technologists employed in the field of welding have very little formal training in the practical and theoretical aspects of welding. Between 2006, when SAIW Certification became the Authorised National Body (ANB) of the International Institute of Welding (IIW) in South Africa, and the end of 2011, an average of less than four International Welding Engineers (IWE's) were registered per year in this country.

The training of Welding Engineers and Welding Technologists is regulated internationally and the International Institute of Welding's training programme "International Education and Qualification System for Welding Personnel" is currently the only system recognised worldwide. In South Africa SAIW Certification (a Section 21 not-for-profit company, accredited with SANAS and the International Institute of Welding, responsible for the assessment and certification of welding personnel in South Africa) acts as the Authorised National Body (ANB) for IIW. The IIW programme is well supported by local and international industry and recognised by international training and accreditation entities, such as the current ISO and CEN bodies (recognised in ISO 14731: Welding Coordination - Tasks and Responsibilities).

- **Chair in Nuclear Engineering – Prof. Johan Slabber**

The MOU was signed in July 2017 between the University of Pretoria and the National Nuclear Regulator (NNR). The focus area is to support the National Nuclear Regulator (NNR) in their interaction with the University of Pretoria and other partner institutes both local and international in fulfilling their requirements in:

- Education and Training
- Research and Development
- Provision of Technical Support

In his duties, the Chair will be called the CNSS host co-ordinator/chair for nuclear safety and security.

- **SARChI Chair in Carbon Technology and Materials – Prof. Ncholu Manyala**

The main research focus areas of this Chair are nuclear graphite, the fabrication and characterisation of new carbon/graphite materials, composites and thermal materials, graphite oxidation and nano-carbon, with the emphasis on graphene research, which includes synthesis and characterisation, as well as applications to photovoltaic and energy storage as super capacitors and graphene/conducting polymer composites as gas sensors. This multi-disciplinary research Chair was awarded to the University of Pretoria in 2006, and is now in its second five-year term as part of SARChI.

- **SARChI Chair in Advanced Sensor Networks – Prof. Attahiru Alfa**

The main research focus of this Chair, established in January 2015, is building research capacity in the area of advanced sensor networks, a modern and growing field, which is strategic to the economy. The first five years of the programme will target research on the mathematical aspects of wireless sensor networks (WSN), while the subsequent five-year programme will focus on hardware, test beds and implementation aspects. The applications to be considered will have major national interest, especially in the wildlife monitoring, soil and in-situ soil moisture analysis (for viticulture), home security, the monitoring of health infrastructure and human healthcare.

- **SARChI Chair in Artificial Intelligence – Prof. Andries Engelbrecht**

The main research focus of this Chair is computational intelligence, with a particular emphasis on computational swarm intelligence, learning from zero knowledge using competitive co-evolution and evolutionary algorithms. The research team, under the leadership of A-rated researcher Prof. Andries Engelbrecht, has developed an open-source library of computational intelligence algorithms, which is increasingly being used internationally.

- **DST Chair for Fluoromaterials Science and Process Integration – Prof. Philip Crouse**

This Chair was established in 2007 and has been functioning in the Institute of Applied Materials since 2010. Current research includes the development of a fluoro-polymer capability in South Africa. The focus is on polytetrafluoroethylene (PTFE), polyvinylidene fluoride (PVDF), fluorinated ethylene propylene (FEP) and pulverised fuel ash (PFA). Other focus areas include the dry fluorination of inorganic materials, the modelling of fluorine electrolysis cells and various projects of interest to the Advanced Metals Initiative (AMI) relating to fluoride-based minerals processing, and high-temperature processes for the production of high-value products directly from fluorspar.

- **ABSA Chair in Data Science – Prof. N Pillay**

The main focus of the UP Institute for Big Data and Data Science is on both Big Data (BD) and Data Science (DS) research. Big data is a term used to refer to data sets that are too large or too complex such that traditional data processing applications are inadequate. With reference to BD, challenges include data capture, data curation, efficient search or querying, data sharing, storage, transfer, and privacy issues. Data science (DS) refers to the science of managing and analyzing data sets of any size, and of any format. The data science project life-cycle consists of a number of processes applied to the data, from data acquisition to data preparation, hypothesis formulation and modeling, exploratory data analysis, data analytics and visualization, model development and deployment, maintenance and operations, and finally optimization. The UP IBDDS will include all these aspects of BD and DS.

- **DRS Chair in Cybercity – Prof. Jan Eloff**

The MoU was signed in 2017 between the DRS and UP. The focus is to determine a joint programme for training and development in the area of Cybersecurity.

The areas for collaboration are as follows:

- Identification of strategic areas related to Cybersecurity where specialised training would need to be developed and offered to the industry at large.
- DRS to assist UP in developing and packaging appropriate course material that would need to be developed and be offered.
- To look at the possibility of where possible, jointly offer such training and human capital development in Cybersecurity. Such activities may be offered through Enterprises at UP.
- To assist UP in course material, infrastructure and curriculum development at undergraduate and/or postgraduate level so as to better equip graduates in skills related to Cybersecurity.

- To offer bursaries where possible to undergraduate and postgraduate students and hence develop the next generation of experts for the South African and African business sector and DRS in particular while also addressing an international need.
- Assist UP to develop historically disadvantaged persons (particularly black females) through undergraduate and postgraduate financial and other support to meet their industry needs.
- DRS and UP to work together to identify potential research projects that could be Honours, Masters or PhD topics or areas of further research.
- DRS to look at the possibility of offering students internship in industry so as to give them the exposure that would enrich their learning and training experience.
- DRS to through their network of business associates or customers, undertake to assist in developing further collaboration or pooling of resources for certain identified objectives as decided from time to time between DRS and UP.
- Investigate the opportunity and support for the development of a DRS Centre for Cybersecurity within the Department of Computer Science at UP.
- Aspire to develop a national centre of excellence for South Africa with international reputation.

North-West University

- **SARChI Research Chair: Coal Research – Prof. J R Bunt**

Eskom funded this Chair to the amount of R3.5 million a year for five years until 2016. Prof. Bunt was seconded from Sasol to take up the research Chair in 2013 to develop capacity in the field of coal science and technology. The main thrust of the coal research programme at the NWU ranges from molecular modelling of coal structures (nano-scale), to reactivity/kinetic studies (micron-scale), and to lump coal pyrolysis and gasification studies (mm scale). The research portfolio of the Chair addresses value addition across the entire coal value chain from (1) fine coal processing (drying fundamentals, stockpile drainage, dry coal beneficiation), (2) coal utilisation optimisation (coal breakage, briquetting, smokeless fuels, reactivity and kinetics, mineral transformational behaviour, tar, catalytic gasification), through to (3) waste utilisation (CO₂ utilisation, ash utilisation, acid mine drainage eradication). There is a strong focus on the development of innovative new technologies and the need to maintain a clean environment.

- **Department of Trade and Industry/SARChI Chair in Nuclear Engineering – Prof. J du Toit**

The research Chair was awarded in 2006. The main focus of the research is on computer modelling of reactor neutronics and thermohydraulics to simulate how particular reactors behave under various conditions. Thermalfluid systems modelling is an important tool in the analysis, design, optimisation, licensing and operation of reactors and power plants as well as in the development of plant simulators. Its applicability is not limited to a specific type of reactor or technology and therefore provides a valuable training platform to prepare candidates for joining the local or international nuclear industry. Modelling is also an important cross-cutting topic in each of the proposed next-generation IV nuclear reactor systems. The purpose of the SARChI Chair in Nuclear Engineering is to carry out research, and perhaps more importantly, develop the human capital needed in order to run an effective and safe nuclear energy sector. The National Research Foundation (NRF) recently awarded a research grant to the SARChI Chair in Nuclear Engineering as part of the South Africa/South Korea intergovernmental research cooperation programme. The research project focuses on the development of the very high temperature reactor (VHTR) design and analysis technology.

- **SARCHi Chair in Biofuels and other Clean Alternative Fuels – Prof. S Marx**

The current incumbent, Prof. Marx, has held the research Chair since 2007. Her Bio-Energy research group is a transdisciplinary research group comprising microbiologists, chemical engineers, biochemists and chemists. They undertake research in the field of second and third generation bio-refineries including both biochemical and thermochemical production routes. They are currently one of only two groups in South Africa working in the field of thermochemical liquefaction, producing biochar, which is a coal substitute and a soil remediation agent. They are the only group in South Africa working in the field of hydrotreatment of oils/biomass for high value fuels production.

The group has developed three biofuel prototypes: a waterless biodiesel plant that utilises campus waste to produce diesel for use on campus and a continuous liquefaction production plant that produces bio-oil, biochar and biogas. They also have a community engagement project in which local communities are trained to make soap from biodiesel glycerine waste and soap leftovers from local guesthouses.

- **Hydrogen Energy: DST HySA Infrastructure Centre of Competence – Dr Dmitri Bessarabov**

The DST developed the National Hydrogen and Fuel Cells Technologies (HFCT) Research, Development and Innovation (RDI) Strategy. This research is conducted through NWU and CSIR. The Chair is associated with this programme and research grouping
Website: <http://engineering.nwu.ac.za/research/hydrogen-south-africa-hysa>

- **Smart Grid Research Chair – Prof. APJ Rens**

Prof. Rens was appointed to the Chair in 2013. The research work of the Chair is housed within the Unit for Energy Systems. Research is conducted through five sub-programmes: nuclear energy, hydrogen energy, fossil energy, renewable energy and energy management. These areas are linked to additional research chairs at NWU associated with other energy sources.

Tshwane University of Technology

- **Enabled Environments for Assisted Living – Prof. K Djouani**

This research Chair was initiated in January 2014 and is hosted by the French South African Institute of Technology (F'SATI). The focus of research is on the development of mechatronic and networked technologies to assist disabled persons and the elderly. Applications are wide ranging and may include public transport systems, public spaces, educational environments etc. The aim is to develop innovative solutions that enable people with varying disabilities to be fully integrated into mainstream society. F'SATI is a French South African postgraduate institute for teaching, research and development with two nodes - one at TUT in Pretoria and one at CPUT in Cape Town, which offers Masters and Doctorates with a high added value. Strongly supported by the French Ministry of Foreign Affairs (MAEDI), the DST and the NRF, the institute has become a leading centre in scientific innovation.

- **Acid Mine Drainage Treatment – Prof. C Wolkersdorfer**

The research Chair was established in 2014. The research aims to contribute to the solution of mine water-related problems. The research Chair will contribute to solving mine water-related problems by conducting applied research on mine water management and treatment as well as prevention of mine water pollution. It will focus on passive treatment technologies in remote areas and active treatment where local water sources or people might be directly affected by the pollution. Key active technologies will be electrochemistry and the integration of various technologies into new water treatment methods. Another focus of research will

be the understanding of the flooding process itself and stratification in flooded underground mines by means of tracer tests and optimized monitoring methods.

Website: <https://www.tut.ac.za/rni/research/rr/prof-wolkersdorfer>

- **Rand Water Chair in Water Utilisation – Prof. M Onyango**

The Chair was awarded to the university by Rand Water. Current research deals with process development for nanomaterials production, design and fabrication of nanodevices for water treatment, developing integrated systems for managing “difficult-to-treat” wastes such as acid mine drainage, producing membranes from biomaterials, and heavy metals and emerging contaminants removal from water. The challenges the water industry faces as a result of population growth, climate change, deterioration of water quality and quantity and competing demands require novel innovative highly advanced technologies. It is for this reason that his research has mainly focused on nanotechnology for water treatment. Nanotechnology is expected to completely change the water treatment as it is known today and to reach new frontiers through accelerated technology development.

Website: <https://www.tut.ac.za/rni/research/research-chairs/prof-onyango>

- **Gibela Research Chair in Manufacturing and Skills Development – Prof. K Mpofo**

The primary discipline of this Chair is industrial engineering, manufacturing engineering, manufacturing and related skills development. The Chair is funded from 2016 – 2021. Prof. Mpofo's field of expertise and research specialisation is Industrial Engineering with the focus on advanced manufacturing technologies, knowledge-based systems, and robotics applications in manufacturing.

Website: <https://www.tut.ac.za/rni/research/research-chairs/prof-mpofo>

University of the Witwatersrand

- **DHET-DST/NRF SARCHI Chair in Post-School Education and Training (PSET): Clean Coal Technology – Prof. R Falcon**

The main focus of the research Chair and its associated research group is the characterisation of coal and the advancement of technologies and industry practices to increase coal conversion efficiency and decrease environmental impact. The Chair commencement date was 2007. Current research interests involve:

- Advanced understanding of the nature, transformation and performance of coal and its derivatives (coal, coke, char, minerals, trace elements, ash) in a variety of processes using petrography and other advanced techniques;
- Designing or adapting coal-fired plant (pf, FBC) to meet the reducing coal qualities (specifically combustion for power generation);
- investigating the implementation of new CCT processes (UCG);
- Developing advanced biomass forms for co-firing with coal;
- Developing improved or alternative coal-based carbon reductants for the metallurgical industry; and
- Examining the cost-effectiveness and environmental impact of the new technologies.

- **DHET-DST/NRF SARCHI Chairs in Post-School Education and Training (PSET): Hydrometallurgy and Sustainable Development – Prof. S Ndlovu**

The focus of the research within the Chair is on the development of hydrometallurgical process routes and technologies that can assist in the extraction of metal values from mainstream traditional sources and alternative sources (such as mine dumps, lean ores, complex ores, solid and liquid metallurgical process waste) in order to meet current and anticipated metal

demand. Research is centered on the major metals found in Southern Africa such as gold, PGMs, and base metals. The core focus is on resource recovery through the development of new process routes, optimisation, modification and or integration of existing technologies. A platform for the comprehensive utilisation of metal bearing wastes from metallurgical industries is used to also look at other metals such as vanadium, aluminium and titanium. Focus is on the development of green technologies or processes that are more energy efficient offer a reduced environmental footprint and are cost effective

Website: <https://www.wits.ac.za/chemmet/research/research-chairs/hydrometallurgy/>

- **DHET-DST/NRF SARCHI Chairs in Post-School Education and Training (PSET): Sustainable Process Engineering – Prof. T Majazi**

Chair commencement date was January 2007. The main research interest is batch chemical process integration.

Website: www.wits.ac.za/chemmet/research/research-chairs/sustainable-process-engineering/

- **The Chamber of Mines Chair in Extractive Metallurgical Engineering – Prof. E Hurman**

The chair holder is a professor of extractive metallurgy and also the Finland Distinguished Professor in the Sustainable Production of Ferroalloys.

- **The Element 6 Chair in Ceramic Science – Prof. J Sigalas**

The Materials for Energy Research Group (MERG) is the home of most of the activities of the Chair. MERG is divided into four focus areas: (a) modelling and design, (b) synthesis and processing, (c) characterisation and testing, (d) real properties and applications. A fifth focus area is (e) behaviour, which consists of collaborations with industrial partners outside of MERG.

- **The SAIW Chair in Welding and Fabrication Engineering – Prof. A Paterson**

Research associated with this Chair embraces two fields, (1) the fabrication of welded process plants that conform to health legislation and (2) the characterisation of cast-wrought interfaces in welded fabrications of structural steels. This characterisation permits modelling by finite element analysis (FEA).

Cape Peninsula University of Technology

- **Innovative Small Satellite Technology & Applications for Africa – (CPUT is currently in the process of filling this chair)**

This Chair commenced in 2014. The Chair is hosted in the French South African Institute of Technology (F'SATI) and will leverage on its national and international flagship Postgraduate Programme in Satellite Systems Engineering, which was responsible for the launch of the first South African and African CubeSat in 2013. It is CPUT's flagship programme. The satellite, which measures only 10 cm³, is designed to transmit data on the ionosphere that will improve understanding of the sun's interaction with the earth's magnetic field. Small satellites deliver information at much lower costs than conventional satellites. Applications of a distributed network of small satellites include disaster monitoring, telemedicine, science exploration, environmental and resources management, asset tracking etc. Current research interests include attitude control of small satellites, design and analysis of multi-satellite systems, and space debris mitigation and remediation strategies. The research team has developed the world's smallest control moment gyroscopes that were flown on SwampSat. The team designed and built DebrisSat (a representative satellite for debris characterisation) and performed a hypervelocity impact test to emulate an on-orbit collision. Another research interest is M-DOF vibration testing.

University of Cape Town

- **Computational mechanics – Prof. B Reddy**

This Chair is held by a professor in the Mathematics Department at UCT but is formally located in the Department of Mechanical Engineering in the Centre for Research in Computational and Applied Mechanics (CERECAM). CERECAM provides a coherent focus and point of interaction for fundamental and applied research in computational and applied mechanics.

- **Nanomaterials for catalysis – Prof. P Kooyman**

Prof. Kooyman took up this research Chair from the Catalysis Engineering groups at TU Delft (the Netherlands). She has unique expertise in the field of *in-situ* material characterisation using electron microscopy. Her research focuses on heterogeneous catalysis, especially catalyst characterisation. She is an expert in high resolution transmission electron microscopy and is one of the pioneers in gas-phase *in situ* TEM. This Chair was awarded to the DST-NRF Centre of Excellence in Catalysis, c*change, and her activities are closely aligned with the various programmes and projects that are being conducted in the Centre of Excellence.

Website: <http://www.cchange.ac.za/2015/11/27/patricia-kooyman/>

- **Reaction Engineering**

This Chair is currently vacant.

- **SARChI Biomedical Engineering and Innovation – Prof. T S Douglas**

The biomedical engineering programme at the UCT has the potential to address some of South Africa's unique public health challenges and to contribute to growth of the local medical device industry, directly and indirectly, through research activities and postgraduate education. Full realisation of this potential requires engagement with the clinical practice environment and with industry. Achievements in medicine and engineering that have improved living conditions and life expectancy in the developed world over the past 150 years include diagnostic, therapeutic and rehabilitative medical devices. These are tangible outcomes of the practice of biomedical engineering. Innovation in medical devices is considered key to progress in public health, but the development of devices that meet clinical needs is not sufficient to ensure implementation. Practitioners must also understand the industry that will manufacture and distribute devices, and be aware of drivers and constraints in the business environment.

- **DST Research Chair in Bioprocess Engineering – Prof. S Harrison**

UCT's Centre for Bioprocess Engineering Research (CeBER) is home to the DST Research Chair in Bioprocess Engineering as well as seven academic staff members; approximately four to eight postdoctoral fellows at any given time; and close to 45 postgraduate students. Commencement date of this Chair was January 2008.

Research in biohydrometallurgy centres on metal extraction from sulphidic minerals through tank and heap bioleaching of low grade and complex ores and electronic waste, biological sulphate reduction for AMD treatment, AMD prevention and value from waste through the circular economy, industrial ecology and maximising of resource productivity approaches.

The research programme centres on the establishment of generic knowledge at the molecular and metabolic, unit operation and the sustainable process levels for benefit across specific bioprocesses. This fundamental basis is particularly facilitated through the SARChI Chair in Bioprocess Engineering and provides a platform to apply the knowledge generated into South Africa-specific processes. These contribute across water treatment and remediation, renewable energy, human health products including nutraceutical and anti-microbials, commodity

bioproducts including polymers, fine chemical products including enzymes and pigments, minerals beneficiation, resource productivity and renewable resources.

Website: www.ceber.uct.ac.za OR www.chemeng.uct.ac.za/staff/academic/harrison

- **Minerals Beneficiation – Prof. D Bradshaw**

The Chair was initiated in 2008 and forms part of the Minerals to Metals initiative, one of UCT's key research groups that was established in 2007. The focus is on adding value from minerals resources while incorporating sustainability principles.

Website: www.mineralstometals.uct.ac.za

- **Industrial Computational Fluid Dynamics – Prof. A G Malan**

The Chair commencement date was April 2014. The main research focus is on the development of a new multi-physics CFD technology. This has resulted in the Elemental™ software, which employs novel programming and numerical techniques specifically designed for large-scale parallel computing. Current research areas include free-surface modelling with phase change for the aerospace and space industries; aeroelastic simulations for small as well as large aircraft; biomedical modelling; adjoint optimisation and reduced-order-modelling (ROM) technologies. The research component of the work typically involves developing improved discretisation techniques and advanced parallel solvers.

Website: <http://www.mecheng.uct.ac.za/mec/staffprofiles/amalan> and <http://www.incfduct.ac.za/overview-18>

- **Carbon Materials and Technology – Prof. N Manyala**

The SARChI Chair in Carbon Materials and Technology was established in 2006 within the Institute. Under the guidance of Prof. Brian Rand, a world leader in carbon materials research and NRF A-rated scientist, the Chair has grown and expanded its focus from mainly nuclear materials into new and exciting areas. Research efforts are currently directed towards graphene and other nano-material applications. A graphene synthesis laboratory has been established and there is research on the synthesis of graphite materials from local feedstocks.

University of KwaZulu-Natal

- **Fluorine Process Engineering & Separations Technology – Prof. D Ramjugernath**

Research contributes towards chemical process development and optimisation in South Africa and abroad and actively contributes to the Government's Fluorochemical Expansion Initiative (FEI) by researching and developing South Africa's fluorinated products. The activities are integral to the development of a fluorochemicals industry in the country and directly linked to Necsa and SASOL. Although South Africa possesses the second largest reserves of fluorspar (the starting material for all fluoro - chemicals), it currently imports almost all of its fluorinated products. There is very little beneficiation of the fluorspar reserves in the country and the activities under the Chair assist in addressing the problem by developing technology and human capacity to drive the development and expansion of a fluorochemical cluster. The research activities under the Chair are not limited to fluorochemicals, but also cover the areas of chemical thermodynamics and separation technology. Thus, the Research Unit has one of the best equipped laboratories in the Southern Hemisphere and is one of the largest groups working in this field.

- **James Fulton Chair in Mechanical Engineering – Prof. G Bright**

The research focus is on mechatronics, robotics and advanced manufacturing systems.

Website: http://mecheng.ukzn.ac.za/School_Leadership_and_Staff/GlenBright.aspx

- **PRASA (Passenger Rail Agency of South Africa) Engineering Research Chair – Prof. N Fourie**

This Chair comprises a multi-engineering discipline research group strategically positioned in the Department of Industrial Engineering to research and solve railway and related engineering problems. The research Chair initiates and executes research into aspects of maintenance management and applicable engineering management principles best suited to the needs of PRASA. Research areas include, but are not limited to: energy management, reliability engineering and big data analysis.

Website: <http://ie.sun.ac.za/research/prasa-eng-chair/>

- **Advanced Macromolecular Architectures – Prof. L Klumperman**

The focus of the Chair is the synthesis and characterisation of advanced macromolecular architecture and the control of morphology and functionality on the nanometer length scale. The kinetics and mechanisms of polymerisation reactions are also investigated. One of the new research directions is the study of polymer-peptide conjugates for targeted treatment of specific diseases. The research is at the interface among polymer science, chemistry, biochemistry, physiology and in some cases, microbiology.

Website: www.sun.ac.za/english/research-innovation/Research-Development/research-facts/sa-research-chair-on-advanced-macromolecular-architectures

- **Biofuels and other Clean Alternative Fuels – Prof. W Van Zyl**

Prof. Emile van Zyl is the Senior Chair of Energy Research (CoER): Biofuels and other alternative clean fuels at Stellenbosch University. His group has been active in the bio-fuel research field for more than 10 years, focusing specifically at the developing of next generation recombinant yeast that produced the necessary enzymes for efficient fermentation of all hexose and pentose sugars present in cellulose and hemicellulosics, the major polysaccharides present in plant material.

Website <https://www.sun.ac.za/english/research-innovation/Research-Development/research-facts/research-chairs>

- **Scatec Solar Chair in Photovoltaic (PV) Systems – Prof. A Rix**

The Chair is supported by Norwegian global solar energy provider Scatec Solar - the first company to supply electricity to South Africa's national grid under the country's Renewable Energy Independent Power Producer Programme. It will enable SU to expand its role in renewable energy research focusing on optimising electricity generation from PV plants, and will provide support to the PV industry. The Chair will form partnerships with other research institutions in the general field of PV systems.

- **South African National Roads Agency Limited (SANRAL) Chair in Pavement Engineering – Prof. K Jenkins**

The SANRAL Chair in Pavement Engineering is located in the Geotechnical and Transportation Division of the Department of Civil Engineering. The incumbent of this Chair (conducts his research within the Institute for Transport Technology. The pavement research group in the Department of Civil Engineering is currently undertaking projects in the fields of materials performance research, numerical modelling and sustainable practices.

- **Electromagnetic Systems and EMI Mitigation for Square Kilometre Array – Prof. D Davidson**

The commencement date of this Chair was January 2011. Prof. Davidson works in the field of applied electromagnetics. For most of his career, his work has focused on Computational

Electromagnetics (CEM) – the numerical solution of Maxwell's equations – and supporting technologies, in particular high-performance computing. He has worked closely on further developments of FEKO, a leading EM simulation program, and has collaborated extensively with local industry on this. Since his appointment to the SKA Chair in 2011, the scope of his work has expanded significantly to address radio astronomy. This includes extensions of CEM techniques to specific problems in antenna design for SKA, as well as consideration of signal processing for radio telescopes, and antenna calibration issues. He is also principal investigator of the joint SU-UCT research programme, “MeerKAT High Performance Computing (HPC) for Radio Astronomy”, continuing an earlier flagship project of the national facility, the Centre for High Performance Computing.

With the success of the SKA site bid announcement in May 2012, South Africa will be hosting the lion's share of the SKA. This highly international project relies on a number of technologies, including applied electromagnetics, his speciality. The ability to accurately predict and efficiently model antenna performance is crucial at both the design stage, as well as during operation; in the latter case, modern calibration methods increasingly require accurate models of the antenna beams. Overall, the theory of electromagnetics underlies much of electronic engineering, in particular radio frequency and microwave engineering. This, in turn, underpins crucial technologies in major industries, including telecommunications, wireless, radar, remote sensing and many defence applications. As such, his work is relevant in both radio astronomy, as well as in much wider fields of electronic engineering, as evidenced by his elevation to Fellow of the IEEE in 2012, with the citation “for contributions to computational electromagnetics”.

- **Nanostructured Functional Materials – Prof. L Barbour**

This Chair encompasses the study of structure-property relationships in synthetic crystals. The research involves the design of molecules that pack in the solid state such that their relative arrangements give rise to interesting and useful functionality. It also focuses on the design and assembly of these materials, and studies their structures at the molecular level with a view to understanding the direct link between form and function. Barbour's research group mainly focuses on the discovery, design, assembly and characterisation of new functional materials with interesting properties. In particular, we are interested in exploring and understanding structure-property relationships relating to (i) porous materials and (ii) materials that undergo unusual thermal behaviour (e.g. anomalous thermal expansion, thermosalience, phase transitions, etc.).

Website <https://www.sun.ac.za/english/research-innovation/Research-Development/research-facts/research-chairs>

- **National Aerospace Centre (NAC) Research Chair in Aeronautical Dynamics & Control – Prof. J Engelbrecht**

The goal of this Chair, situated in the Department of Electrical & Electronic Engineering, is to promote the development of skills and technology in automatic flight control of aircraft for the benefit of the South African aerospace industry. The research group performs research on the flight control of aircraft ranging from unmanned aerial vehicles to large passenger airliners.

Website <https://www.sun.ac.za/english/research-innovation/Research-Development/research-facts/research-chairs>

Central University of Technology

- **SARChI Medical Productive Development – Prof. I Yadroitsau**

The research Chair is situated in the Centre for Rapid Prototyping and Manufacturing (CRPM), established in 1997. The focus of research is on medical product development through Additive Manufacturing, commonly known as 3D printing. The CRPM uses rapid prototyping, rapid manufacturing, rapid tooling and medical product development technologies to further education, understanding and development.

University of Johannesburg

- **Research and Innovation Chair: Green Economy – Prof. P Naidoo**

The Chair was jointly established by UJ's Faculty of Engineering and the Built Environment (FEBE) and the Directorate of Economic Development, City of Johannesburg (CoJ).

Durban University of Technology

- **SARChI Development and Optimisation of WasteWater Treatment Technology for Developing Economies – Prof. TA Stenstrom**

DUT was awarded the first SARChI in Development and Optimisation of WasteWater Treatment Technology for Developing Economies. The Institute for Water and Wastewater Technology encompasses a dynamic group of researchers and support personnel involved in innovative research. The focus of research at IWWT is within the broad areas of water treatment, wastewater treatment and beneficiation, algal biotechnology and Biohydrogen Production. The SARChI Chair's project themes in regard to water include:

- Improving the understanding of microbial action in full-scale biological wastewater treatment facilities with the intention of optimisation and troubleshooting.
- Developing and adapting low-cost alternative wastewater treatment technology for rural and peri-urban application.
- Utilisation of lipid producing microalgae for the tertiary/polishing of final effluent from domestic wastewater.
- Catchment and technology- (toolbox) based integration of health, well-being and environment.
- Wastewater treatment and reuse for crop and energy production.

APPENDIX F

RECODING OF HEMIS DATA FOR ANALYSIS

| |
|---|
| <p>“Collection year” This field remained unchanged in our database.</p> |
| <p>“Qualification type” We extracted the following codes from HEMIS: 07, 28 and 49 (masters students) and 08, 30, 50 (doctorate students).</p> |
| <p>“Degree type” This was a newly created field to group the different degrees together. Records coded as 07, 28 and 49 were recoded as ‘masters’ and records coded 08, 30 and 50 were recoded as ‘doctorate’.</p> |
| <p>“Date of birth” This field remained unchanged in our database.</p> |
| <p>“Year of birth” A newly created field to indicate only the year of birth of each student.</p> |
| <p>“Gender” This field remained unchanged in our database.</p> |
| <p>“Race” This field remained unchanged in our database.</p> |
| <p>“Nationality” This field remained unchanged in our database.</p> |
| <p>“Region” A new field was created to group student from different countries into regional areas. The purpose of this field was to compare students from South Africa with students from other countries. Three regional groups were created: “South Africa”, “ROA” (Rest of Africa) and “ROW” (Rest of the World).</p> |
| <p>“Qualification commencement date” This field remained unchanged in our database.</p> |
| <p>“Year commenced” A newly created field to indicate only the year in which each student commenced their studies.</p> |
| <p>“Age at commenced” A new field was created to calculate the age of each student when they first started their degree.</p> |
| <p>“Qualification requirements status” This field remained unchanged in our database.</p> |
| <p>“Age at graduation” A new field was created to calculate the age of each student when they had successfully completed their degree. The age was determined by “Collection year” – “Year of birth” +1, under the condition that the qualification requirement status was coded as “F” - the HEMIS code for successful completion.</p> |

“Time to degree”

We created a new field to calculate the number of years that each student took to complete their studies. The time was calculated as “Collection year” – “Year commenced” +1, under the condition that the qualification requirement status was coded as “F” - the HEMIS code for successful completion.

“CESM category for first area of specialisation”

We extracted only the records which began with the code “08” as per the CESM classification system. For a detailed description on CESM categories, please refer to Appendix A and B.

“CESM field”

This field was created to link the CESM code to the field description, as is defined by the CESM classification system.

“Engineering field”

From 1999-2007 the CESM classification system used a 4-digit code to categorize scientific fields into 22 different subject areas, with related fields. Between 2008 and 2009, the codes were changed to six digits, but the field descriptions remained unchanged. From 2010, the CESM codes changed yet again. A system of 6-digit codes remained but the subject areas and related fields were changed. For this study, we were fortunate to be able to extract all records where the code began with “08” as the code prefix had not changed since 1999. To account for the changes in code suffix, we matched the old field descriptions to the new field descriptions and created 33 unique fields for the Engineering domain. A list of the CESM codes and descriptions for 1999 – 2007, 2008 – 2009 and 2010+ can be found in Appendix B. The re-classification of fields for this study is included as Appendix A.

“Institution code”

This field remained unchanged in our database.

“HEI abbreviation”

In 2005, a number of higher education institutions had merged to form new institutions. All records for the years 2001 to 2004 were mapped to the post-2005 merged institutions.

APPENDIX G

GENDER DIMENSION OF POSTGRADUATE ENGINEERING IN SOUTH AFRICA: CONSULTATIVE WORKSHOP

List of workshop attendees

| # | NAME | INSTITUTION/ORGANISATION |
|-----|--------------------------|---|
| 1. | Prof. Chaya Herman | University of Pretoria |
| 2. | Prof. Esther Akinlabi | University of Johannesburg |
| 3. | Ms Aditi Lachman | WomEng |
| 4. | Dr Nozipho Motsa | University of Zululand |
| 5. | Dr Ron Beyers | Young Engineers and Scientist of Africa |
| 6. | Dr Elizabeth Rasekoale | President African Gong-International development consultant on Gender |
| 7. | Prof. Olubukola Babalola | Organisation for Women in Science for the Developing World |
| 8. | Ms Zizwe Thikazi | University of Pretoria |
| 9. | Ms Samukelisiwe Bhembe | University of Pretoria |
| 10. | Ms Chenai Ngorima | University of Pretoria |
| 11. | Ms Fungai Jaji-Hwehwe | University of Pretoria |
| 12. | Dr Charity Kombe | University of Pretoria |
| 13. | Ms Lifutso Tsephe | University of Pretoria |

APPENDIX H

DATA PROCESSING AND ANALYSIS

- Data was analysed by extracting data sets from the various data sources and compiling them in a spreadsheet for analysis and plotting graphs.
- In order to minimise the effect of differences in data collection and processing methodologies by data sources where direct comparisons were made, the same data sources were used for all countries as far as possible.
- Different countries have different higher education structures, classifications and definitions for terms. (For example, in South Africa there are dual doctorate paths: DTech via Universities of Technology and PhDs via universities, but doctoral data is lumped together). The same or equivalent data sets were used as far as possible in the comparisons. Major differences are noted in the relevant sections of the document.
- UNESCO ISCED 2011 classification was used wherever possible for Bachelors or equivalent (ISCED 6), Master's or equivalent (ISCED 7), Doctoral or equivalent (ISCED 8) (UNESCO Institute for Statistics, 2012).
- Note that, for South Africa, National Diplomas are ISCED 5, and thus excluded from the ISCED 6 numbers. Also, postgraduate diplomas and Honours degrees are classified as ISCED 6 and included in the ISCED 6 numbers (UNESCO Institute for Statistics, 2018).
- Date ranges: data was collected for the period 2008 to the most recent data available for each country.
- For South African data, CESM category 8 (engineering) was used for engineering-specific indicators, where applicable (Department of Higher Education and Training (DHET), 2008).
- Stats SA education levels were mapped to ISCED 2011 levels as follows:

| ISCED 2011 level | Stats SA education level |
|------------------|---|
| 5 | Diploma with Grade 12 |
| 6 | Higher Diploma; Bachelor's degree; Bachelor's degree and Postgraduate Diploma; Honours degree |
| 7 & 8 | Post Higher Diploma (Master's, Doctoral Diploma); Higher degree (Master's, PhD) |

For the effectiveness (supply vs. demand) analysis, average engineer employment data per industry category for the period 2010 to 2016 was used instead of annual granular data. This is due to erratic numbers in the Stats SA Labour Market Survey database, likely due to extrapolation from too small sample sizes. For example, according to the Stats SA database, the total number of engineers employed in South Africa fell from 103 586 to 69 915 between 2015 and 2016 (Statistics South Africa, 2018b). This is highly unlikely. Stats SA employment data was therefore only used for estimating relative distribution between engineering fields and industry sectors (and averaged across years).

- For the effectiveness (supply vs. demand) analysis, the second order CESM categories were mapped to the Stats SA engineering occupational categories as follows:

| Stats SA occupational categories ³⁶ | CESM 2 nd -order categories (up to 2009) (Eng. = Engineering; Tech. = Technology) (HEDA, 2010) | CESM 2 nd -order categories (2010 onwards)) (Department of Higher Education and Training (DHET), 2008) | |
|---|---|--|--|
| Civil engineers | 080600 – Civil Eng. & Tech. | 080700 – Civil Eng. 082600 – Construction Eng. | |
| Electrical engineers | 080800 – Electrical Eng. & Tech. | See footnote ³⁷ | |
| Electronics and telecomm. engineers | 080700 – Computer Eng. & Tech. 081500 – Instrumentation Eng. & Tech. | 080800 – Computer Eng. 080900 – Electrical, Electronics and Communications Eng. | |
| Mechanical engineers | 080100 – Aerospace & Aeronautical Eng. & Tech. 080300 – Automotive Eng. & Tech. 081600 – Manufacturing Eng. & Tech. 081700 – Marine Eng. & Tech. 081900 – Mechanical Eng. & Tech. 082200 – Nuclear Eng. & Tech. 082300 – Ocean Eng. | 080100 – Aerospace, Aeronautical & Astronautical Eng. 081500 – Mechanical and Mechatronics Eng. 081800 – Naval Architecture and Marine Eng. 081900 – Nuclear Eng. 082000 – Ocean Eng. 082900 – Manufacturing Eng. | |
| Chemical engineers | 080200 – Agricultural Eng. & Tech. 080400 – Bio-Eng. & Tech. 080500 – Chemical Eng. & Tech. 081200 – Environmental Eng. & Tech. 081800 – Materials Eng. & Tech. 082400 – Petroleum Eng. | 080200 – Agricultural/Biological Eng. and Bio-Eng. 080400 – Biomedical/Medical Eng. 080500 – Ceramic Sciences and Eng. 080600 – Chemical Eng. 081300 – Environmental / Environmental Health Eng. | 081400 – Materials Eng. 082100 - Petroleum Eng. 082400 – Materials Science 082500 – Polymer/Plastics Eng. |
| Mining engineers; Metallurgists and related professionals | 081300 – Geological Eng. 082000 – Metallurgical Eng. & Tech. 082100 – Mining Eng. & Tech. | 081600 - Metallurgical Eng. 081700 – Mining and Mineral Eng. 083200 – Geological / Geophysical Eng. | |

| Stats SA occupational categories ³⁶ | CESM 2 nd -order categories (up to 2009) (Eng. = Engineering; Tech. = Technology) (HEDA, 2010) | CESM 2 nd -order categories (2010 onwards)) (Department of Higher Education and Training (DHET), 2008) | |
|---|---|--|--|
| Architects; engineers and related professionals not elsewhere classified; Industrial / production engineers; Quantity surveyors | 080900 – Graphics and Drafting for Eng. & Tech. 081000 – Engineering Mechanics 081100 – Engineering Science 081400 – Industrial Eng. & Tech. 082500 – Surveying and Mapping 089900 – Other Eng. and Eng. Tech. | 080300 – Architectural Eng. 081000 – Engineering Mechanics 081100 – Engineering Physics 081200 – Engineering Science 082200 – Systems Eng. 082300 – Textile Sciences and Eng. | 082700 – Forest Eng. 082800 – Industrial Eng. 083000 – Operations Research 083100 – Surveying Eng. 089999 – Engineering, Other |

³⁶ Engineering technicians with diplomas (ISCED 5) were included in the total engineer numbers (ISCED 5 – 8) from Stats SA.

³⁷ The 2008 version of CESM (as implemented from 2010 onwards) does away with Electrical Engineering as a separate category and combines it with Electronic and Communications Engineering.