Radar and Electronic Defence

Modules from a Masters Programme offered to Continuing Professional Development students

The Masters Programme

To address the growing need for skilled engineers and scientists in the challenging fields of Radar and Electronic Defence, the University of Cape Town (UCT) and the Council of Science and Industrial Research (CSIR), in conjunction with international partners and industrial sponsors, including the King Abdulaziz City for Science and Technology (KACST), have established a Masters Degree in Engineering (MEng) with specialisation in Radar and Electronic Defence. Hosted in Cape Town, South Africa, students studying towards this degree will focus on relevant theory, technologies and applications with both coursework and project components. The programme had its first intake of students in February 2011.

Each course typically contains a lecture component of 5 full days, followed by weekly online seminars and tasks culminating in a written examination, over a five week period after the first, intensive lecture session. The programme is designed to facilitate students that cannot be resident in Cape Town for the full duration to complete all courses, by using distance learning techniques during the follow up period after each course (after the one week intensive lecture period). All students will, however, have to be present in Cape Town for the one week lecture period for each course. Elements of continuous assessment (problem sets, short projects) and a written examination are utilised to assess student performance.

For further information on the Masters Programme please refer to the website http://radarmasters.co.za/

Continuing Professional Development

Modules of this Masters Programme are offered to Continuing Professional Development students as separate certificated courses from which a participant can obtain CPD credits as these courses are registered with ECSA. These CPD courses are attendance based, and a certificate of attendance is issued.

CPD COURSES:

Introduction to Radar (EEE5119Z) 15-19 February 2016

5 CPD points, ECSA course code: UCTRED116

The principal aim of this course is to introduce students to the fundamental principles underlying radar systems and to enable them to understand and apply these principles to generic radar systems. The subject is specifically structured around these aims. On successful completion of this course, students will be able to:

- describe the main principles underlying radar systems.
- understand the role of each component of a radar system.
- use the radar equation to describe the performance of radar systems.
- understand how target and environmental characteristics affect the choice of system design parameters.
- describe and assess the relative advantages of different types of radars.

Presenter: Dr Piet van Genderen

Tracking Filter Engineering – The Gauss-Newton and Polynomial Filters (EEE5132Z)

29 February to 4 March 2016

5 CPD points, ECSA course code: UCTRED216

The course provides a detailed introduction to tracking filter engineering based on the Gauss-Newton and polynomial filters. At the start of the Satellite Age in 1958, three tracking filters competed for acceptance at Bell Labs, viz.

- Gauss-Newton filters,
- Swerling filters, and
- Kalman filters.

This course touches briefly on the Swerling and Kalman filters, covers the Gauss-Newton filters in full depth, and covers in full depth the widely used ***polynomial filters***, which were devised by the lecturer when he worked at Bell Labs between 1964 and 1968

Presenter: Dr Norman Morrison

Mathematics for Radar and Electronic Protection (EEE5108Z) 14 to 18 March 2016

5 CPD points, ECSA course code: UCTRED316
This course provides a useful mathematical toolkit for the Radar and Electronic Defence Engineer. Emphasis is on practical calculation and useful 'tricks of the trade' rather than mathematical rigour.
Specific course topics include (estimated number of lectures and acronyms shown in brackets):

- Ordinary differential equations (7) (ODE)
- Laplace transforms (3) (LT)
- Fourier analysis (3) (FA)
- Partial differential equations (2) (PDE)
- Complex analysis (8) (CA)

Presenter: Dr Pieter Uys (University of Cape Town)

Introduction to Electronic Defence/Warfare (EEE5120Z) 4 to 8 April 2016

5 CPD points, ECSA course code: UCTRED416
Topics covered:

- Electronic defence: threats, requirements and principles
- Advanced radar threat
- Modern electronic attack (EA) systems — architecture, types, and technology
- EA against modern radar systems
- Digital radio frequency memory
- Electronic defence support
- Expendables and decoy systems
- Directed energy weapons and stealth technology
- Applications of electronic defence

Presenters: Ferdie Potgieter and Jacobus Vlok (Council for Scientific and Industrial Research)

Fundamentals of Radar Signal and Data Processing (EEE5105Z) 09 to 13 May 2016

5 CPD points, ECSA course code: UCTRED516
This course presents the principles and techniques fundamental to the operation of the signal processing found in a radar system. The course follows the recommended textbook very closely.
Specific course topics include:

- Fundamentals of radar signals & signal processing
- Threshold detection of radar targets
- Constant false alarm rate detectors
- Doppler processing
- Radar measurements
- Radar tracking algorithms
- Fundamentals of pulse compression waveforms
- Overview of radar imaging

Presenter: Dr Amit Mishra and Dr Andrew Wilkinson (University of Cape Town)

High Resolution and Imaging Radar (EEE5111Z) 06 to 10 June 2016

5 CPD points, ECSA course code: UCTRED616
Course overview:

- Part 1: High resolution radar topics, e.g. applications of the radar range equation in HRR, HRR design, HRR waveforms, synthetic high-range-resolution radar
- Part 2: Synthetic aperture radar topics, e.g. SAR concepts, SAR signal properties, SAR processing algorithms
- Part 3: Inverse synthetic aperture radar topics, e.g. ISAR concepts, ISAR geometry and signal modelling, radial motion compensation, image formation, interpretation of ISAR images, ISAR imaging using CLEAN techniques; polarimetric ISAR; recent advances.

Presenters: Prof Marco Martorella and Prof Fabrizio Berizzi (University of Pisa, Italy)

Radar Systems Modelling (EEE5112Z) 26 to 29 July 2016

5 CPD points, ECSA course code: UCTRED716

A practical course which requires a sound knowledge of Radar Systems and Signal Processing, and teaches you how to used that knowledge to synthesise the design of a system to a requirement. This skill is essential when involved with the design of a sensor, or evaluating the usefulness of a sensor for specific applications.

The approach taken is in two parts: Firstly, we analyse an existing system, to predict and compare performance against advertised radar parameters; thereafter, we design improvements to the system, based on practicals and project work by the student. The system considered is just one example of the broad field of radar, i.e. Air Traffic Control radar, but the systems thinking is widely applicable.

Presenters: Prof Mike Inggs (UCT), Dr Jaco de Witt (CSIR) and Mr Kumaran Naicker (CSIR)

COURSE INFORMATION

Programme Convenor:

A/Prof Daniel W. O'Hagan , University of Cape Town

Lecturers

Daniel W. O'Hagan – University of Cape Town
Mike Inggs – University of Cape Town
Amit Mishra – University of Cape Town
Ferdie Potgieter – CSIR
Pieter Uys- University of Cape Town
Barry Downing – University of Cape Town
Scott Glenn – Rutgers University, USA
Hugh Roarty – Rutgers University, USA
Piet van Genderen – Delft University of Technology, The Netherlands
Maria Greco – University of Pisa, Italy
Fulvio Gini - University of Pisa, Italy

Who should attend?

Attendees are responsible for ensuring they have the necessary experience and educational background to derive full benefit from the course.

Format

Each module is structured in the following way:
a week of intensive contact time at UCT, comprising formal lectures, class assignments and seminars/tutorials

Cost

The fee for each course is R10 000.00. The fee includes a comprehensive set of course notes. Recommended text books are for the student's account.

Certificates and CPD Points

A certificate of attendance will be awarded to CPD participants. Participants need to attend 80% of the lectures to qualify for an attendance certificate.

CPD participants can also request a formal university transcript, which will show this course as part of a Professional Development Career.

Please note: If you are interested in attending this course for credit purposes, you will need to register for the Masters Programme or as an occasional student. If you attend the course as a CPD participant, credit cannot be claimed in retrospect.

Venue

All lectures will take place in Cape Town. Information on the specific venue will be sent to you after your application has been approved.

Application and Cancellation

Registration forms are available on the website www.cpd.uct.ac.za/applications/

In order to ensure a place on the course applicants must complete and return a signed registration form to the course administrators: Heidi Tait or Sandra Jemaar: ebe-cpd@uct.ac.za

Confirmation of acceptance will be sent on receipt of a registration form.

Registrations close one week before the start of each course

Cancellations must be received one week before the start of a course, or the full course fee will be charged.