Radar and Electronic Defence

Modules from a Masters programme being 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, are establishing a Masters Degree in Engineering. 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 will have its first intake of students in February 2011.

Each course will typically contain a lecture component of 5 full days, followed by weekly seminars, tasks and a written examination, over a five week period after the first, intensive lecture session. The programme is designed to support students that cannot be in 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 the course.

For further information on the Masters Programme please refer to the website <http://sites.google.com/site/radarmasters>

**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.

**THE CPD COURSES INCLUDE:**

**Mathematics for Radar and Electronic Defence: 4 – 8 February 2013**

Course overview. Real and complex numbers, their functions, and integral and differential calculus in one dimension. Matrices, vectors, operators and eigenvalue problems, Functions of several variables, including vector calculus, functions of a complex variable and contour integration, and the calculus of variations, Integral transforms: Fourier, Laplace, Mellin, Hankel transforms, and the FFT. Course topics include: • Ordinary differential equations • Laplace transforms • Fourier analysis • Partial differential equations • Complex analysis • Vector calculus.

**Introduction to Radar**: **4 – 8 March 2013**

Introduction to Radar, the range equation, radar detection in interference, propagation effects and mechanisms, characteristics of clutter, target reflectivity, target reflectivity fluctuations, Doppler processing, Radar antennas, transmitters and receivers, radar signal processing, radar remote sensing.

Textbook: *Principles of Modern Radar*, Scitech Publishers

**Radar Signal and Data Processing: 8 - 12 April 2013**

Fundamentals, threshold detection, constant false alarm rate detector (CFAR), Doppler processing, Radar measurements, Radar tracking algorithms, fundamentals of pulse compression, overview of radar imaging.

Textbook: *Principles of Modern Radar*, Scitech Publishers

**Introduction to Electronic Defence: 13 - 17 May 2013**

Electronic Defence: Threats, Requirements and Principles, Advanced Radar Threat, Modern Electronic Attach (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.

**High Resolution and Imaging Radar: 3 – 7 June 2103**

• High resolution radar topics, e.g. applications of the radar range equation in HRR, HRR design, HRR waveforms, synthetic high-range-resolution radar

• Synthetic aperture radar topics, e.g. SAR concepts, SAR signal properties, SAR processing algorithms • 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

**Clutter and Detection in Clutter: 24 – 28 June 2013**

*Part 1: Ground and Sea Radar Clutter Modelling:*

• Statistical modelling of radar clutter

• Experimental Validation: Ground Clutter Data

• Clutter simulation for radar performance evaluation

*Part 2: Coherent Radar Target Detection in Heavy Tailed Clutter:*

• Coherent Detection of Radar Targets in non-Gaussian Disturbance

• Adaptive Implementation of Detectors in non-Gaussian Disturbance

• Advanced radar detection under mismatched signal models

**Multi-Target Multi-Sensor Tracking and Data Fusion: 29 July – 2 August 2013**

*Part 1: Multi- Target Tracking (selected topics from):*

• Basics of Target Tracking

• Sensor and Source Characteristics

• Modelling and Tracking Dynamic Targets

• Passive Sensor Tracking

• Attribute Data Fusion

• Multiple Sensor Tracking System Implementation and Applications

• Reasoning Schemes for Situation Assessment and Sensor Management

• Tracking System Performance Prediction and Evaluation

*Part 2: Kinematic Data Fusion:*

• Data/Information Fusion Models.

• Strategies and Algorithms

• Performance Evaluation of Data Fusion Systems, Software, and Tracking

• Applications of Multi-sensor Systems and Data Fusion

• Sensor Management in Data Fusion Systems

**COURSE INFORMATION FOR CPD PARTICIPANTS**

***Programme Convenor:***

Prof Barry Downing, University of Cape Town

***Prospective guest lecturers***

Amit Mishra – University of Cape Town

Ferdie Potgieter - CSIR

Fabrizio Berizzi – University of Pisa  
Fulvio Gini – University of Pisa

Marco Martorella – University of Pisa  
Maria Greco – University of Pisa  
Pieter de Villiers- University of Pretoria

Pieter Uys- University of Cape Town

Pieter van Genderen - Netherlands

***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 participants who attend 80% of the lectures for each course. According to Guidelines set out by the Engineering Council of South Africa, attendance of this course will earn a participant credits towards Category 1 (Developmental Activities).

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

In order to ensure a place on the course applicants should complete and return a signed application form to the course administrators: Heidi Tait or Sandra Jemaar:

Confirmation of acceptance will be sent on receipt of an application form.

Applications 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**

***Administrators***

Heidi Tait or Sandra Jemaar:

CPD Programme, EBE Faculty Office, Menzies Building, University of Cape Town

Phone: 021 650 5793  
Fax: 021 650 2669

Email: ebe-cpd@uct.ac.za