



Dept. of Electrical Engineering | CPD courses

Radar and Electronic Defence

Masters Modules 2023



Introduction

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 master's degree in Engineering (MSc, Eng and MEng) with specialisation in Radar and Electronic Defence. The Programme is hosted in Cape Town, South Africa and 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.

For further information on the master's programme please visit: <http://www.radarmasters.uct.ac.za/>

Degree Structure

A master's degree requires students to pass 180 credits of coursework and dissertation, with one credit requiring about 10 hours of work. Thus, the average time required to complete a master's degree is about 1800 hours of work.

The master's degree in Radar is offered with three different degree structures:

1. **Professional Taught Master's Degree (MEng Radar):**

This master's degree consists of 6 x 20 credit courses and a 60-credit mini dissertation. There are two core courses, viz. Introduction to Radar and Mathematics, plus four more specialized radar courses. We also offer a stream of Electronic Defence within this degree structure.

2. **Research Master's Degree with Coursework (MSc (Eng) Electrical Engineering Specializing in Radar):**

This master's degree consists of 3 x 20 credit courses and a 120-credit dissertation. The core course is Introduction to Radar, plus two more specialized radar courses.

3. Research Master's Degree by Dissertation (MSc (Eng) Electrical Engineering Specializing in Radar):

This master's degree requires a 180-credit research dissertation. This degree is intended for students with radar experience who would not benefit from the coursework, or students who wish to tackle a large research project.

Continuation or Upgrade to PhD

Students who complete and pass any of the three master's degrees can continue to study for a PhD. Alternatively, students who are registered for either of the MSc (Eng) Research master's degrees and who are progressing well with their studies, can upgrade to a PhD without completing the master's degree.

Occasional Postgraduate Registration

We offer the option of registering as an occasional postgraduate student for individual courses for non-degree purposes. For busy people who work in industry, but who would like to register for a master's degree, the option exists to pass some or all of the 6 courses over 2 or 3 years, whilst continuing to work in industry, and to complete the remaining courses and the minor dissertation in less than 1-year full time. The credits passed as an occasional student can be transferred into the degree.

Entry Requirements for a Radar Master's Degree

1. A 4-year Engineering Degree or Science Honours degree with at least 2 years of Mathematics.
2. A BTech Degree from a South African University of Technology with at least 5 years of experience in Radar or another relevant field.
3. A 3-year Bachelor of Science degree with at least 2 years of Mathematics and 5 years of experience in Radar or another relevant field.
4. A level of competence that has been attained in any other manner, which, in the opinion of Senate and on the recommendation of the Faculty, is adequate for the purpose of admission as a candidate for the degree.

Please refer to the website www.radarmasters.uct.co.za/ for further information or contact the programme convenor at stephen.paine@uct.ac.za for additional information.

Continuing Professional Development (CPD) courses

Modules of this master's 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.

Who should attend?

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

Methods of Instruction

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

Please note: All courses will take place on UCT campus. Venue details to be confirmed

Overview 2022 Programme

Programme	Radar and Electronic Defence Masters Modules
Courses and dates	Introduction to Radar Systems EEE5119Z: 27 February – 3 March 2023 Advanced Mathematics EEE5108Z: 13 – 17 March 2023 Radar Signal and Data Processing EEE5105Z: 11 – 14 July 2023 Advanced Radar Technology and Algorithms EEE5132Z: 2 – 6 October 2023
Venue	Upper Campus, University of Cape Town
CPD	CPD points and ECSA codes as indicated per module
Participants	Attendees are responsible for ensuring they have the necessary experience and educational background to derive full benefit from the course.
Fees	5-day course: R16 500 UCT staff and students: R8 250

Introduction to Radar

EEE5119Z: 23 February – 3 March 2023

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.

Presenters: Prof Piet Van Genderen

5 CPD points, ECSA course code: UCTREDITR23

Advanced Engineering Mathematics

EEE5108Z: 13 – 17 March 2023

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. The textbook, *Advanced Engineering Mathematics*, E. Kreyszig (Wiley) (with many editions available but edition 9 preferred) is prescribed. Some notes are also made available to assist the student.

Specific course topics include:

- Ordinary differential equations
- Laplace transforms
- Fourier analysis
- Partial differential equations
- Complex analysis

Presenters: Dr Chayan Bhawal and Dr Kuntal Deka

5 CPD points, ECSA course code: UCTREDAEM23

Radar Signal and Data Processing

EEE5105Z: 11 – 14 July 2023

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

Presenters: Prof Fulvio Gini and Prof Maria Greco

5 CPD points, ECSA course code: UCTREDRSDP23

Advanced Radar Technologies and Algorithms

Focussing on Machine Learning Techniques for Cognitive Radar and Electronic Defence

EEE5132Z: 2 – 6 October 2023

In recent years, the processing of radar signals has changed from a fixed scheme towards an adaptive behaviour that depends on the targets and the background. This content aware radar processing is one key element of a modern *cognitive radar*. To achieve this kind of processing, a cognitive radar is using machine learning techniques, i.e. the radar is analysing the data and changing its parameters according to a given performance measure. The introduction and analysis of some commonly used machine learning techniques for radar applications and electronic defence is the content of this lecture.

Presenters: Dr Simon Wagner and Dr Sebastian Durst

5 CPD points, ECSA course code: UCTREDARTA23

Registration

Registration and Cancellation

- [Register online](#)
- Registration covers attendance of all sessions of the course and course material.
- Registrations close one week before the start of the course. Confirmation of acceptance will be sent on receipt of a registration form.
- **Cancellations must be received one week before the start of a course, or the full course fee will be charged.**
- For more information on application and registration procedures, please visit our website: <http://www.cpd.uct.ac.za/cpd/registration-policies>

Certificates and CPD Points

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

According to guidelines set out by the Engineering Council of South Africa, attendance of this course will earn participants 5 points towards Category 1 (Developmental Activities). The ECSA validation numbers are stipulated with the courses.

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

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

Contact details:

For more information or details on CPD courses, visit our website or contact us.

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