



Dept. of Electrical Engineering | CPD courses

Radar and Electronic Defence

Masters Modules 2021



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.

Please note: Due to limitations imposed by COVID 19, the courses will adopt a hybrid approach whereby those capable and willing to be on campus will be physically present while the course will simultaneously be presented online to those who can't be physically present.

Additionally, due to the availability of the lecturer, the Microwave Devices and Antennas course includes a public holiday.

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: Due to limitations imposed by COVID 19, the courses will adopt a hybrid approach whereby those capable and willing to be on campus will be physically present while the course will simultaneously be presented online to those who can't be physically present.

Additionally, due to the availability of the lecturer, the Microwave Devices and Antennas course includes a public holiday.

Overview 2021 Programme

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|--------------------------|--|
| Programme | Radars and Electronic Defence Masters Modules |
| Courses and dates | Microwave Devices and Antennas (EEE5132Z): 22 – 26 March 2021 (please note: this includes a public holiday) Advanced Mathematics (EEE5108Z): 19 – 23 April 2021 Introduction to Radar Systems (EEE5119Z) 10 – 14 May 2021 Introduction to Electronic Defence (EEE5120Z): 5 – 9 July 2021 Advanced Radar Technology and Algorithms (EEE5132Z): 13 – 17 Sept 2021 Fundamentals of Radar Signal Processing (EEE5105Z): 25 – 29 Oct 2021 |
| Venue | Upper Campus, University of Cape Town <u>or</u> online if necessary |
| 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 | R15 000 (5-day course) |

Microwave Components and Antennas

EEE5121Z

This course describes the operation and design of microwave components used in radar and telecommunication systems. The course follows the recommended textbooks very closely.

Specific course topics include:

- Review of EM theory
- Antenna parameters
- Transmission lines
- Network analysis
- Antenna elements
- Power dividers and couplers
- Impedance matching
- Waveguides
- Oscillators, PLLs and mixers
- Array theory
- FEKO and Microwave Office

Presenters: Francois Schonken and Stephen Paine

Date: Monday 22 – Friday 26 March 2021

5 CPD points, ECSA course code: UCTREDMCA21

Advanced Engineering Mathematics

EEE5108Z

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

Presenter: Pieter Uys

Date: Monday 19 April – Friday 23 April 2021

5 CPD points, ECSA course code: UCTREDAEM21

Introduction to Radar

EEE5119Z

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: Prof Mike Cherniakov, Prof Marina Gashinova and Prof Mike Antaniou

Date: Monday 10 – Friday 14 May 2021

5 CPD points, ECSA course code: UCTREDITR21

Introduction to Electronic Defence

EEE5120Z

The course will assess the fundamentals of Electronic Defence, focusing on radar applications.

Having successfully completed this course, students should achieve:

- Understanding of Electronic Defence main concepts
- Understanding of Electronic Support regarding its concepts and knowledge of ES measures and activities
- Understanding of Electronic Attack regarding its concepts and knowledge of EA measures and techniques
- Understanding of Electronic Protection regarding its concepts and knowledge of EP applications
- Understanding of Electronic Intelligence regarding its concepts and knowledge of ELINT activities and applications
- Understanding of the fundamentals of system architectures and basic signal processing techniques that are used in Electronic Defence.

Presenters: Craig Tong, Francois Maasdorp

Date: 5 – 9 July 2021

5 CPD points, ECSA course code: UCTREDIED21

Advanced Radar Technologies and Algorithms

EEE5132Z

This course is organized in three parts, which mainly cover aspects related to High Resolution Radar (HRR), Synthetic Aperture Radar (SAR) and Inverse Synthetic Aperture Radar (ISAR).

Having successfully completed this course, students should:

- Understand the concept behind high resolution radar, SAR and ISAR
- Understand the techniques that are currently used in high resolution radar, SAR and ISAR and be able to choose which ones are the most suitable for a given scenario,
- Understand the significance of using SAR/ISAR images in a number of applications,
- Be able to implement simple SAR/ISAR algorithms,
- Understand the main differences between radar imaging of static scenes and non-cooperative moving targets,
- Be able to predict radar imaging performance in some scenarios.

Presenters: Marco Martorella

Date: Monday 13 September – Friday 17 September 2021

5 CPD points, ECSA course code: UCTREDARTA21

Radar Signal and Data Processing

EEE5105Z

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: Chris Baker

Date: Monday 25 October – Friday 29 October 2021

5 CPD points, ECSA course code: UCTREDRSDP21

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 4 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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