MRes programme

Course structure and modules

2020-21

Contents

MRes course structure

Below is an overview of the MRes programme structure for 2020-21.

Mini-projects
45 credits each, choose two

Module 1 **Electronics Components & Systems**	**Module 2** **Photonic Components & Systems**
15 credits each, choose one	15 credits each, choose one
Elective Modules	**Business Modules**
15 credits each, choose two	15 credits each, choose one
Skill Development	**Seminars & events**
Compulsory courses, depending on the institution at which you are registered	Attendance is required

Coronavirus (Covid-19) update

Important information about potential changes to modules for 2020/21.

The catalogues have been updated with key information about the modules that will run during the 2020/21 academic session.

Please note, the information in the catalogue is subject to change as teaching and assessment arrangements for 2020/21 may need to be adjusted further in response to the coronavirus (Covid-19) outbreak should the situation change. Activities such as field trips and placements may also be subject to change or cancellation.

Every effort has been made to ensure that confirmed adjustments to teaching and assessment arrangements have been updated in all module descriptions.

Mini projects

45 credits each

MRes students must complete two mini-projects in the academic year:
- Mini project 1 (part time, November – May)
- Mini project 2 (full time, May – August)

Students are provided with a list of available projects for each session.

MRes modules

Module catalogues

The modules available for students on the MRes programme for 2020-21 are listed below, along with a short summary of each. More detailed module descriptions, teaching and assessment information are provided within the online catalogues:

UCL: https://www.ucl.ac.uk/module-catalogue/

University of Cambridge: http://teaching20-21.eng.cam.ac.uk/node/3003

Which modules to choose

During Induction Week the CDT will host a session on the MRes programme structure, modules and projects to help students make their module choices. We also encourage students to discuss modules and career pathways with academics to help them choose the right modules.

Students should follow the MRes programme structure when selecting modules:
- Module 1 - Electronics Components & Systems: choose one (1)
- Module 2 - Photonic Components & Systems: choose one (1)
- Elective Modules: choose two (2)
- Business Module: choose one (1)
- Skill Development Modules: these will be allocated, depending on the institution at which the student is registered.

Module 1: Electronics Components & Systems

15 credits each, choose one.

(Cambridge) 4B13 - Electronic Sensors & Instrumentation

This module aims to introduce students to state-of-the-art practice in electronic instrumentation systems, including the design of sensor/transducer elements for physical measureands, their respective interface electronics and precision measurement techniques.

http://teaching20-21.eng.cam.ac.uk/content/engineering-tripos-part-iib-4b13-electronic-sensors-instrumentation-2020-21

(Cambridge) 4B24 - Radio Frequency Systems

This module will focus on the system aspects of RF design (as opposed to circuits). The aim is that circuits (amplifiers etc.) can be reduced to a blocks with a minimum number of parameters from which the system performance can be estimated and optimised to meet a specification.

http://teaching20-21.eng.cam.ac.uk/content/engineering-tripos-part-iib-4b24-radio-frequency-systems-2020-21

(Cambridge) 4B25 - Embedded Systems for the Internet of Things

The module will introduce students to the principles underlying sensor operation, signal acquisition, the role of measurement uncertainty and noise, common sensor communication interfaces and how they interact with modern embedded microcontrollers.

http://teaching20-21.eng.cam.ac.uk/content/engineering-tripos-part-iib-4b25-embedded-systems-internet-things-2020-21

(UCL) ELEC0115 - RF Circuit and Devices

This module aims to give students a good grounding in a range of RF devices including the fundamentals of device physics, RF circuits, system architectures and noise measurement techniques.

https://www.ucl.ac.uk/module-catalogue/modules/rf-circuits-and-devices-ELEC0115

Module 2: Photonic Components & Systems

15 credits each, choose one.

(Cambridge) 4B11 - Photonic Systems

This module examines the advance of optical techniques into electronic systems for computation and communications, two- and three-dimensional transmission, storage and processing of information using free space optics. Applications such as computer-generated holography, optical correlation, optical switching and adaptive optics are highlighted through the use of liquid crystal technology.

http://teaching20-21.eng.cam.ac.uk/content/engineering-tripos-part-iib-4b11-photonic-systems-2020-21

(Cambridge) 4B23 - Optical Fibre Communication

The module will cover the theory and practice of modern optical fibre communication systems which currently achieves a capacity of 800 Gbit/s per wavelength. A systems approach is taken, focusing on the fundamental mathematical modelling of devices, subsystems and systems, to allow students to design and analyse future systems rather than merely reflecting latest technological developments.

http://teaching20-21.eng.cam.ac.uk/content/engineering-tripos-part-iib-4b23-optical-fibre-communication-2020-21

(UCL) ELEC0049 - Optical Transmission Network

This module provides the student with an advanced understanding of the physical layer of optical transmission systems and networks on different time- and length-scales.

https://www.ucl.ac.uk/module-catalogue/modules/optical-transmission-and-networks-ELEC0049

(UCL) ELEC0078 - Photonic Subsystems

This module will give you an in-depth understanding of the design, fabrication, operation and performance of advanced photonic devices for a variety of applications, including optical-fibre communications and solar power generation.

https://www.ucl.ac.uk/module-catalogue/modules/photonic-subsystems-ELEC0078

(UCL) ELEC0109 - Advance Photonic Devices

This module provides an in depth understanding at the device level of the optical sources, modulators, detectors and passive optical devices used in communications and other applications such as imaging and solar energy conversion.

https://www.ucl.ac.uk/module-catalogue/modules/advanced-photonics-devices-ELEC0109

Elective Modules

15 credits each, choose two.

(Cambridge) 4B5 - Quantum and Nano-technologies

The aim of this module is to introduce the concepts underlying quantum mechanics and nanotechnology, and see how to apply them to problems relevant to electrical engineering.

http://teaching20-21.eng.cam.ac.uk/content/engineering-tripos-part-iib-4b5-quantum-and-nano-technologies-2020-21

(Cambridge) 4F5 - Advanced Information Theory & Coding

This course will introduce students to applications of information theory and coding theory in statistics, information storage, and cryptography.

http://teaching20-21.eng.cam.ac.uk/content/engineering-tripos-part-iib-4f5-advanced-information-theory-and-coding-2020-21

(Cambridge) 4F8 - Image processing & Image Coding

Sophisticated processing of images by digital hardware is now fairly common, and ranges from special effects in video games to satellite image enhancement. This module introduces the key tools for performing tasks such as video data compression, image enhancement, and scene understanding, and shows how these can be applied.

http://teaching20-21.eng.cam.ac.uk/content/engineering-tripos-part-iib-4f8-image-processing-imaging-coding-2020-21

(Cambridge) 4F12 - Computer Vision

The aims of the course are to: introduce the principles, models and applications of computer vision; cover image structure, projection, stereo vision, structure from motion and object detection and recognition; and give case studies of industrial (robotic) applications of computer vision.

http://teaching20-21.eng.cam.ac.uk/content/engineering-tripos-part-iib-4f12-computer-vision-2020-21

(UCL) ELEC0050 - Broadband Communication Lab

This course introduces students the test and measurement equipment and techniques that are used to characterise optical and RF devices and systems.

https://www.ucl.ac.uk/module-catalogue/modules/broadband-communications-laboratory-ELEC0050

(UCL) ELEC0057 - Physics and Optics of Nanostructures

This course aims introduce the diverse field of nano-optics. It will focus on unique optical properties of structures with dimensions smaller than the optical wavelength.

https://www.ucl.ac.uk/module-catalogue/modules/physics-and-optics-of-nano-structures-ELEC0057

(UCL) ELEC0088 - Software for Network and Services Design

This course teaches the essential programming concepts for networking using the python programming language. This includes basic programming concepts, essential data structures, object orientation and an introduction to machine learning.

https://www.ucl.ac.uk/module-catalogue/modules/software-for-network-and-services-design-ELEC0088

(UCL) ELEC0108 - Broadband Technologies and Components

This module introduces the technologies involved in the design and construction of transport networks (wireless, copper and optical) and the applications areas in which they are used.

https://www.ucl.ac.uk/module-catalogue/modules/broadband-technologies-and-components-ELEC0108

(UCL) ELEC0130 - Internet of Things

This module is designed to provide students with solid technical knowledge and skills to build Internet of Things (IoT) systems. This is an intensive, highly interactive, hands-on course in which students are expected to complete exercises involving system design, device programming and cloud development.

https://www.ucl.ac.uk/module-catalogue/modules/internet-of-things-ELEC0130

(UCL) ELEC0134 - Applied Machine Learning Systems I (MLS-1)

This module will cover basic principles and practice of machine learning systems engineering. In particular, topics such as introduction to machine learning engineering, supervised learning algorithms, unsupervised learning algorithms, kernel learning and neural networks.

https://www.ucl.ac.uk/module-catalogue/modules/applied-machine-learning-systems-i-mls-1-ELEC0134

Business Modules

15 credits each, choose one.

(UCL) ELEC0094 - Telecommunication Business Environment

This module deals with strategic management issues related to running a telecommunications operating company [Telco], enabling delegates to appreciate the business perspectives of telecommunications both in the UK and globally.

https://www.ucl.ac.uk/module-catalogue/modules/telecommunications-business-environment-ELEC0094

(Cambridge) 4E4 - Management of Technology

The aims of the course is to provide students with an understanding of: the ways in which technology is brought to market; the frameworks and methods that are both theoretically sound and practically useful; and the challenges and the practical means of dealing with technology in an engineering context.

http://teaching20-21.eng.cam.ac.uk/content/engineering-tripos-part-iib-4e4-management-technology-2020-21

(UCL) COMP0146 - Entrepreneurship theory and practice

This is an entrepreneurship course for students seeking to develop and test a new business idea. It will cover topics such as the selection and deployment of tools as well as techniques and theories for the identification, validation and structuring of a new business venture.

https://www.ucl.ac.uk/module-catalogue/modules/entrepreneurship-theory-and-practice-COMP0146

Generic Skill Development

The following courses may be required or compulsory depending on the institution at which you are registered.

All students - required

Responsible Innovation workshop

The course will introduce you to the idea of Responsible Innovation, its origins, and the background that has led to its development. It will encourage you to consider the ethical responsibilities you have as a researcher, anticipating the impacts of your work and reflecting on the values and assumptions which underpin it. The course includes video presentations, discussions, quizzes, and case studies such as the Manhattan Project and heart disease as a male disease to guide you through the concepts and practices of responsible innovation.

UCL registered students - compulsory

(UCL) ELEC0052 - Transferrable skills

The aim of this module is to allow students to acquire experience of literature surveys, and to develop their writing and presentation skills.

https://www.ucl.ac.uk/module-catalogue/modules/transferable-skills-ELEC0052

Cambridge registered students - compulsory

(RDC) Research Development Course

The Researcher Development Course (RDC) is a programme of researcher development activities and skills training in Engineering. It is compulsory for all Engineering PhD students in their first year at University of Cambridge. The course plays a crucial role in helping graduate students develop the skills they need to complete their PhDs successfully and on time, including the ability to write and present their research (in English). RDC is also a valuable opportunity to learn about the research of others in related fields, research groups and the wider Department.

Seminars and Events

Attendance at the following events is required for all students.

CDT Seminar series

Timing: monthly, November to July

Location: alternates between UCL and University of Cambridge
                 (seminars are currently being hosted online due to Covid-19)

At each seminar one or two PhD students from the photonics CDT will present their research followed by a short question and answer session. We also invite speakers from industry and other fields of research to present to facilitate broader, cross-discipline learning.

The aims of the seminar series are to:
- Enable students to practice presentation skills and check that their research is on track.
- Encourage and provide peer-to-peer learning and feedback.
- Learn from industry speakers.
- Learn from other areas of research that can contribute to your work.

Students are encouraged to ask questions to gain a broader knowledge of the rapidly emerging field of connected electronic and photonic systems.

Industry Day for CEPS CDT

Timing: annually, date TBC

Location: alternates between UCL and University of Cambridge

The photonics CDT hosts an annual Industry Day - a full-day event that brings together industry partners, CDT students and academics to discuss our cutting-edge research as well as opportunities for collaboration in the field of photonics. This is a fantastic opportunity for students to meet key people within the industry and talk about current projects, future research ambitions and career opportunities.

PhD students are required to display a research poster at the event. Posters are optional for MRes students.

The Barlow Memorial Lecture

Timing: biennially (last held 2019), normally in May or June

Location: UCL, Department of Electronic and Electrical Engineering (EEE)

The Barlow Memorial Lecture is held in memory of Harold Everard Monteagle Barlow (1899-1989) who was the Head of the Department of Electronic and Electrical Engineering at UCL from 1950 to 1967. He invented the H01 millimetre waveguide and is remembered for his many contributions to microwave research.

At the event we celebrate the current research of the EEE Department with a research poster display showcasing the work of UCL staff, Masters, PhD and EngD researchers. CDT students are strongly encouraged to display a research poster at the event. Prizes are awarded for the best research posters in different categories.

https://www.ee.ucl.ac.uk/barlow

Mildner Memorial Lecture

Timing: biennially (last held 2018)

Location: UCL, Department of Electronic and Electrical Engineering (EEE)

The Mildner Lecture is held biennially in memory of Raymond Charles Mildner [1907-1977] who, having obtained a BSc (Eng) and an MSc (Eng) from UCL, started his distinguished research career as the holder of the Robert Blair Fellowship. He made major contributions to the technology of power and communication cables, his work spanning an interdisciplinary spectrum from electromagnetic theory through to materials science.

At the event we celebrate the current research of the EEE Department with a research poster display showcasing the work of UCL staff, Masters, PhD and EngD researchers. CDT students are strongly encouraged to display a research poster at the event. Prizes are awarded for the best research posters.

https://www.ee.ucl.ac.uk/mildner