IMPERIAL

Module Specification

Basic details

UID		Cohorts covered (Earliest cohort)	
Long title	Analysis and Design of Circuits		
New code	ELEC40002	New short title	

Brief description of module *(approx. 600 chars.)*

This module provides a foundation in the analysis and design of electronic circuits, introducing key concepts that are essential for higher level study of electronics. You will become familiar with the behaviour of the core electronic components that form the building blocks of all electronic systems. You will also learn how to analyse circuits constructed from these components in order to establish how the voltages and currents at different points are related. This will include both time-domain and frequency domain analysis, and the method of small-signal analysis for handling non-linear components. In the course of the module you will become familiar with a range of standard circuit blocks and gain an appreciation of how these are applied in real world applications.

Available as a standalone module/ short course? N

Statutory details

	ECTS	CATS	Non-credit	
Credit value	10	20	N	HECOS codes
FHEQ level	Level 4			

Allocation of study hours

	Hours	
Lectures	40	
Group teaching	20	*Incl. seminars, tutorials, problem classes.*
Lab/ practical	40	
Other scheduled		*Incl. project supervision, fieldwork, external visits.*
Independent study	150	*Incl. wider reading/ practice, follow-up work, completion of assess*
Placement		*Incl. work-based learning and study that occurs overseas.*
Total hours	250	
ECTS ratio	25.00	

Project/placement activity

Is placement activity allowed? No

Module delivery

Delivery mode	Taught/ Campus	Other	
Delivery term	Year-long	Other	

Ownership

Primary department	Electical and Electronic Engineering
Additional teaching	

departments	
Delivery campus	South Kensington

Collaborative delivery

Collaborative delivery?	N

External institution	N/A
External department	N/A
External campus	N/A

Associated staff

Role	CID	Given name	Surname
Module Leader		Zohaib	Akhtar
Topic Leader		Paul	Mitcheson

Learning and teaching

Module description

Learning outcomes	Upon successful completion of this module you will be able to: 1. Explain the basic physics underlying the operation of the following electronic components: resistor, capacitor, inductor, diode, transistor; 2. Perform DC analysis of circuits containing combinations of the above components to establish the nodal voltages and branch currents; 3. Perform AC analysis of circuits containing combinations of the above components, using small-signal equivalent models to linearise any non-linear elements; 4. Apply the operation of simple transistor level circuits including amplifier stages and logic gates; 5. Analyse basic opamp circuits containing idealised opamps and passive components; 6. Apply the concept of a transfer function and derive the transfer functions for a range of standard filter circuits; 7. Analyse the transient behaviour of 1st order RC and RL networks; 8. Use SPICE to simulate the behaviour of the circuits you have studied; 9. Appreciate where and how the circuits you have studied are applied in real engineering applications.
Module content	Circuit variables - voltage, current, power; Basic circuit elements - sources, resistors; Kirchhoff's laws; Nodal analysis for resistor circuits Linearity and superposition; Thévenin and Norton theorems; Controlled sources Reactive components - capacitor, inductor; Phasors and their application to AC circuit analysis; Power in AC circuits; Transfer functions and filters Non-linear components – diode, transistors (BJT and MOSFET); Large signal analysis of diode and transistor circuits; Linearisation and small-signal analysis of diode and transistor circuits SPICE simulation tool Basic transistor level circuits – amplifiers, logic gates Operational amplifiers – opamp model, common circuit configurations, feedback Transient analysis of 1st order RC and RL circuits

Learning and Teaching Approach	The lectures will be taught in a large lecture theatre to the whole year group using powerpoint presentation and interactive teaching technology supported question and answer sessions. These lectures will be recorded. Exercise classes that consist of about thirty-sixty students will focus on applying the techniques covered in lectures to a variety of problems ranging from the easy to the difficult, with the chance to ask questions and get one-to-one help. These classes involve both individual as well as group work. In tutorial groups of 3-4 students you will have the opportunity to solve a selection of problems with your personal tutor. Laboratory excercises will link the topics taught directly to their applications.Simulations will be part of the learning in applied settings.
Assessment Strategy	There will be two on-line tests one during each reading week. This test will carry 10% of the year weighting. The laboratory work is a part of the module assessment. This assessment will be based on an oral exam that evaluates your understanding of the concepts and your ability to explain and build the experimental set-up. These assessments carry a 30% overall weighting. The final exam will cover all the topics in the module and will carry a weighting of 60%.
Feedback	The on-line tests will generate automatic feedback. Feedback on the oral laboratory exam will be given after the assessments. Feedback on the exams will be giving in after the Supplementary Qualifying Tests have been given. This feedback will come in the form of annotated example answers. The annotations will highly where the student cohort did well and where general problems in understanding were observed.
Reading list	Microelectronic Circuits Sedra & Smith 7th Edition
Required equipment/ software	NA

Quality assurance

Date of first approval	
Date of last revision	January 2025
Date of this approval	
Module leader	Zohaib Akhtar
Notes/ comments	

Office use only

QA Lead	
Department staff	
Date of collection	
Date exported	
Date imported	

Template version

Assessment details

Grading method	Numeric	Pass mark	40%

Assessments

Assessment type	Assessment description	Weighting	Pass mark	Must pass?
Practical	Autumn term laboratory practicals	15%	30%	N
Examination	Autumn term midterm online test	5%	40%	N
Examination	exam at start of summer term	60%	40%	N
Practical	Spring term laboratory practical	15%	30%	N
Examination	Spring term midterm online test	5%	40%	N
		100%		