IMPERIAL

Module Specification

Basic details

UID		Cohorts covered (Earliest cohort)	
Long title	Sensors		
New code	ELEC70101	New short title	

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

Sensors serve as a crucial input platform for a multitude of contemporary analogue and digital systems. They gather physical data to control a diverse array of applications, from everyday devices like espresso machines and thermostats, to more intricate systems such as autonomous vehicles and robotics. While a variety of sensors already exist, each relying on unique physical phenomena, there are ample opportunities for design innovation to enhance their performance and adaptability for a broader spectrum of applications. A thorough understanding of sensor requirements is vital to seize these opportunities.
This module aims to provide a comprehensive understanding of sensor physics. We will commence with a detailed overview of the fundamental characteristics of sensors. Subsequently, we will delve into the physical operation, design, and fabrication of various types of sensors used in industrial control processes, environmental sensing and wearable sensors for healthcare. Sensors will include semiconductor and electromagnetic sensors amongst others. Additionally, we will explore the read-out circuits associated with these sensors. Armed with this knowledge, you will have the opportunity to design, fabricate, and characterise, or simulate a sensor of your own.

Available as a standalone module/ short course? N

Statutory details

	ECTS	CATS	Non-credit	
Credit value	5	10	N	HECOS codes
FHEQ level	Level 7			

Allocation of study hours

	Hours	
Lectures	20	
Group teaching	0	*Incl. seminars, tutorials, problem classes.*
Lab/ practical	20	
Other scheduled	0	*Incl. project supervision, fieldwork, external visits.*
Independent study	85	*Incl. wider reading/ practice, follow-up work, completion of asses*
Placement	0	*Incl. work-based learning and study that occurs overseas.*
Total hours	125	
ECTS ratio	25.00	

Project/placement activity

Is placement activity allowed? No

Module delivery

Delivery mode	Taught/ Campus	Other	
Delivery term	Term 1	Other	

Ownership

Primary department	Electrical 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		Oleksiy	Sydoruk
Topic Leader		Kristel	Fobelets
Topic Leader		Wenkun	He
Topic Leader		Andrew	Holmes

Learning and teaching

Module description

Learning outcomes	By the end of the module, you will be able to: -Describe the physics behind the operation of different sensors -Formulate the requirements on sensor characteristics -Design and characterise sensors for specific applications -Critically analyse the sensor performance in view of design constraints -Fabricate or simulate a sensor and characterise its performance -Design electronic sensor read-out circuits
Module content	Syllabus 1.Overview of sensors as transducers. 2.Fundamental sensor characteristics and constraints. 3.Environmental sensors. 4.Process control sensors. 5.Wearable sensors. 6.Standard sensor read-out electronics
Learning and Teaching Approach	The module will start with a lectures-only period. It will provide you with the knowledge necessary to approach the coursework. The contents of the module will be delivered in mixed mode, with prerecorded videos and face-to-face lectures. The lectures will be supported by in-class formative assessment tests (not-for-marks quizzes) and question & answer sessions. The second half of term will be mainly focussed on coursework involving design, fabrication (where appropriate), simulation, characterisation, and critical evaluation of a chosen sensor. The teaching activity during the period will be face-to-face lab sessions

Assessment Strategy	The module will have three assessments: 1. Coursework. The aim of the coursework is to design, optimise, fabricate (build read-out electronics) and characterise a sensor. The students will be able to choose between multiple topics. Coursework will be caried out in small groups of 3-4 students. 2. Demonstration. The students will demonstrate the operation of their sensor and/or the system that is developed. In-depth knowledge of sensor operation and its suitability for the application will be a key component of the assessment. 3. Computer-based test. The test will be administered and marked electronically. The questions will cover all the material taught in lectures and will focus on concepts.
Feedback	Informal feedback during lectures can be obtained by participating in lecture quizzes. Informal feedback on progress can be obtained by joining the support classes and engaging in the discussions within the cohort or within coursework groups. Formal written formative feedback will be given on the coursework report.
Reading list	Jacob Fraden, Handbook of Modern Sensors Physics, Designs, and Applications, Fourth Edition ISBN 978-1-4419-6465-6 e-ISBN 978-1-4419-6466-3 DOI 10.1007/978-1-4419-6466-3 Springer New York Heidelberg Dordrecht London

Quality assurance

Date of first approval	February 2022
Date of last revision	April 2024
Date of this approval	May 2024
Module leader	Oleksiy Sydoruk

Office use only

QA Lead	
Department staff	
Date of collection	
Date exported	
Date imported	

Notes/ comments

Template version

Assessment details

Grading method	Numeric	Pass mark	50%

Assessments

Assessment type	Assessment description	Weighting	Pass mark	Must pass?
			50%	
Coursework	Final report group project	60%	50%	N
Examination	Wiseflow MCQ test	30%	50%	N
Practical	Demonstration	10%	50%	N
		100%	50%	Y