Imperial College London

Module Specification (Curriculum Review)

Basic details

			Earliest cohort	Latest cohort
UID		Cohorts covered	2021-22	
Long title	Principles of Instrumentation			
New code	PHYS60008	New short title	Principles of Instrumentation	

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

The Principles of Instrumentation course provides an introduction to the principles and practice of instrument science. This is a "directed study" course with significant academic engagement through regular contact sessions and a substantial 'hands-on' element in the lab. Students will be introduced to concepts in the electronics of scientific instruments through a combination of course notes and problem sheets released weekly, and practical laboratory work. In lab students will use the National Instruments LabVIEW™ ELVIS prototyping system to build and characterise key instrument components such as input/output transducers, amplifiers and filters.

656 characters

Available as a standalone module/ short course? N

Statutory details

	ECTS	CATS	Non-credit		
Credit value	5	10	N	HECOS codes	
FHEQ level	Level 6				

Allocation of study hours

	Hours	
Lectures	1	*revision lecture*
Group teaching	18	*Incl. seminars, tutorials, problem classes.*
Lab/ practical	12	
Other scheduled	11	*Incl. project supervision, fieldwork, external visits.*
Independent study	83	*Incl. wider reading/ practice, follow-up work, completion of assessments, revisions.*
Placement		*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		Other	Term 2, exam in term 3

Ownership

Primary department	Physics
Additional teaching	None

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		Henrique	Araujo
Lab Demonstrator		Henrique	Araujo

Learning and teaching

Module description

Learning outcomes	On completion of this module you will be able to: • demonstrate knowledge of the principles and practice of instrument science • demonstrate knowledge of essential concepts in electronics • build and analyse circuits using the National Instruments LabVIEW™ ELVIS prototyping system • use Fourier and Laplace methods to solve equations representing signal propagation in a circuit • describe sources of noise in instruments and methods for its reduction
Module content	• Sensors and transducers; 'real-world' sensors and their non-ideal behaviour • The physical principles of some commonly used sensors • Signal characteristics; fundamental limits on measurement resolution and accuracy • A Fourier understanding of signals • Essential concepts in electronics: passive and active circuits • Interface matching, buffering and amplification • Analogue to digital conversion; digital signals • Use of feedback in the design of sensor systems • Noise: sources, characterisation, and how to maximise the signal-to-noise ratio • Frequency-domain characterisation and the Bode plot • Systems Analysis: linear systems and their differential equations • Solving linear systems using the Laplace Transform
Learning and Teaching Approach	Students will be taught over one term using a combination of directed study accompanied by weekly office-hour sessions, student-led tutorials, and academic-led laboratory sessions. • The timetabled weekly office-hour sessions (9) will include a high-level summary of the week's content, an introduction to the week's problem sheet, and answering questions from the students. • Problem sheets (9) are released weekly, with solutions distributed a week later. At the end of each week one student pair prepares a 1-hr tutorial session for their peers to work through the solutions (or some aspect thereof); their peers assess the quality of the discussion they led. The course academic is not present; an informal report on each session will be solicited from the students along with their marks for the presenting pair. • Lab sessions (4, 3 hrs each) are led by the course academic; students work in pairs. • One revision lecture will take place at the end of the module, with additional office hours.
Assessment Strategy	Assessment is based on a written exam (80% of mark) plus a continuous assessment element (adding to 20%). The latter includes observation of the students' work in lab (5%) plus short Q&A sessions/interviews about the technical work and how this relates to the theoretical aspects (10%); peer-assessment of the student-led tutorial sessions completes the continuous assessment mark (5%).
Feedback	Problem sheets are provided weekly (9 in total) with questions and examples. One student pair presents solutions to these problems to their peers every week; this will allow all students to test their own understanding on a regular basis and to compare their leaning to the wider group. Feedback will be given in lab and atfer lab interviews with the course leader / demonstrator.
Reading list	Detailed notes are provided to students, released weekly. The notes are designed to be self-contained,

and there is no designated textbook for this course. There are, however, excellent textbooks that are suggested as supplementary reading for those wishing to explore some aspects of the course in more

Quality assurance

Date of first approval	
Date of last revision	
Date of this approval	
Module leader	Henrique Araujo
Notes/ comments	

Office use only

QA Lead	
Department staff	
Date of collection	
Date exported	
Date imported	

Template version 16/06/2017

Programme structure

Associated modules

UID	Legacy code	Module title	Requisite type

Programme structure

Associated programmes

UID	Legacy code	Programme title	Core?

Assessment details

		Pass mark
Grading method	Numeric	40%

Assessments

Assessment type	Assessment description	Weighting	Pass mark	Must pass?
Examination	Written Exam	80%	40%	N
Practical	Continuous assessment	20%	40%	N
		100%		