Imperial College London

Module Specification (Curriculum Review)

Basic details

		Earliest cohort	Latest cohort
UID		Cohorts covered	2021	

Long title: Third Year Physics Laboratory

New code: PHYS60004

New short title: Third Year Physics Laboratory

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

Students undertake 3 experimental investigations (from a choice of 12), each lasting three weeks and 30 hours of lab time (90 hours total). Students work in pairs, supported by ~20 experienced demonstrators and are expected to complete additional data analysis and computer modelling outside of laboratory hours, assessed through a presentation, a short report in the style of a 2 page conference abstract and a formal report in the style of a 6 page journal publication. By design, experiments present significant practical and intellectual challenge, with multiple potential paths to success. They provide a bridge between highly structured lab work in the 2nd year, and more open-ended research projects. Experiments include elements of project work, with a core investigation extended in directions chosen by the student. A broad range of practical and intellectual skills are developed, and significant mastery of electronic, optical, computational and other laboratory tools is required.

995 characters

Available as a standalone module/ short course? N

Statutory details

	ECTS	CATS	Non-credit
Credit value	7.5	15	N

HECOS codes:

FHEQ level: Level 6

Allocation of study hours

	Hours	
Lectures	2	
Group teaching	0	*Incl. seminars, tutorials, problem classes.*
Lab/ practical	90	
Other scheduled	0	*Incl. project supervision, fieldwork, external visits.*
Independent study	95.5	*Incl. wider reading/ practice, follow-up work, completion of assessments, revisions.*
Placement	0	*Incl. work-based learning and study that occurs overseas.*
Total hours	187.5	
ECTS ratio	25.00	

Project/placement activity

Is placement activity allowed? No

Module delivery

Delivery mode: Taught/ Campus

Other:

Delivery term		Other	Optional Term 1 or Term 2

Ownership

Primary department	Physics
Additional teaching departments	N/A
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		James	McGinty
Topic Leader		Jing	Zhang
Topic Leader			
Topic Leader			
Topic Leader			
Topic Leader			
Topic Leader			
Topic Leader			

Learning and teaching

Module description

Learning outcomes	On completion of this module you will have :- • Gained (or in some cases extended) experience of a broad range of measurement techniques and processes covering multiple areas of physics (often linked to research activities in the department). • Developed significant practical mastery of research-grade optical and electronic instruments, software and data-analysis tools. • Acquired the ability to identify, develop, test and critically assess new measurement protocols with an expectation that significant background work will be required before high-quality data can be taken. • Developed a more critical and challenging approach to data analysis and the ability to assess and use preliminary data to guide the development of an extended series of measurements. • Learnt to work far more independently, moving towards unstructured project-based work which inherently provides less direct guidance on how to proceed, both in the laboratory and in data analysis and interpretation. • Learnt to expect and respond appropriately to more challenging peer review of experimental methods and data interpretation and to justify and defend the approach chosen. • Practised and refined the ability to document and describe experimental work at a professional level and present final results in a form appropriate for effective communication, e.g. in a peer-reviewed journal, for example working to specific document length and formatting limits.

Module content	Introductory lectures to the laboratory, working methods, safety and interactions with demonstrators. Methods of assessment (lab books and formal reports) are highlighted and supported by "how to" guides and document templates. A choice of three experiments from a total of 12 is made, selected in advance via an online booking system. Each experiment is supported by a laboratory script, a team of 2 or more demonstrators including an academic, and a combination of instruments and software tools. The portfolio of experiments cover a broad range of process, including astronomical image analysis, acoustics, laser spectroscopy, x-ray diffraction, gamma ray scattering, semiconductor and solid state physics, electron photoemission, microwave physics, environmental monitoring and microprocessor control systems. The microprocessor element is covered by an optional 6 week (60 hours) short course that blends mini-lectures and practical work. Lab is typically taken in either term 1 or term 2, with 90 hours of practical work completed in this time, but requiring an additional ~30 hours outside of lab to analyse data and complete a formal report.
Learning and Teaching Approach	3rd year laboratory teaching emphasises independent practical work by a pair of students, with a strong element of critical review of data, informed by a solid base of physical understanding. This approach is driven by the research experience of academic staff and is designed to transition students away from an expectation of "hand holding" and detailed instruction manuals, and provide the tools and confidence necessary to tackle a BSc or MSci research project. Students are provided with a framework to allow them to begin an experiment (formal introductory lectures, an experimental script and "on the ground" introduction to hardware and likely challenges by an experienced demonstrator). However, they are also expected to be self-directing and undertake the majority of the experiment using methods of their own devising. Each experiment is supported by a team of 2 or more demonstrators (~20 total), including a senior academic, and a demonstrator scheduled to attend lab and support students during specified timetabled sessions. Demonstrators are research active physicists and are trained to challenge students to develop and test their own solutions to the problems they encounter rather than providing "easy" answers. Students are warned of this more "adversarial" approach to lab and we highlight that it is a key feature of both academic and industrial research environments. Teaching activities are supported by a team of technicians and administrators who ensure that laboratory equipment is safe and well maintained, appropriate consumables are available, student attendance is monitored and reports and marks are archived and passed on to the Departmental examinations officer. The lab is headed by a senior academic with extensive experience of laboratory teaching across the full range of the Physics BSc and MSci courses. They monitor the performance of the demonstrator team, identify areas where experiments and scripts can be improved, and provides a route for students discuss problems or feed back to the Department on their experience in the lab.

Assessment Strategy	During lab sessions, demonstrators review and comment on lab books and provide formative feedback each week to help students improve their record keeping and develop a professional approach to documenting their work. Three summative assessment approaches are used to represent the common methods of science communication used by research scientists; conference presentation, short form report/abstract and journal publication. Each cycle will be assessed as follows... Cycle 1 - presentation (25% weighting): Each student pair give a joint 10 minute presentation on advanced aspects of their lab work, followed by a few minutes of discussion/questions. Assessed on pace and use of time, formatting/quality of slides, physics content and response to questions. Feedback is provided for each category. Cycle 2 - conference abstract (25% weighting): Each student will have ~1 week to produce a 2 page conference style abstract based on an IEEE template. Cycle 3 - formal report (50% weighting): Each student will have the Christmas/Easter break to produce a 6 page journal style report based on an IEEE template. The written reports are submitted electronically via Turnitin/Blackboard and assessed against a well-defined set of levels of attainment in the areas of Organisation, English and Style, Figures and Data Plots, Demonstration of Skills and Comprehension. Initial 1st marking and commenting takes one week, and reports, comments and marks are then reviewed by the Head of Experiment before formal feedback is provided to the student, with a target of a 14 days for the complete process as submission. Review of Turnitin similarity scores is undertaken for the whole cohort by the head of lab. These assessments are supported by a number of comprehensive guides that highlight good and bad practice, a lecture on expected structure and appropriate error analysis.
Feedback	The primary route for feedback is via a combination of written global and more targeted in-line comments on a copy of the written report or associated with the assessment criteria for the presentation. PDF-format reports are commented electronically, with the density and appropriateness of comments and marking then checked by a more senior second marker (the Head of Experiment) before they are returned by email to students. Students are also strongly encouraged to watch/read examples of effective relevant science communication and compare their work to examples from the research literature to help them develop a fully professional approach to scientific communication. During the lab itself, informal feedback on the students approach to the work is given directly by the demonstrators, and more pointed comments made regarding the lab book. Here indicative marks may be provided to guide students on the quality and completeness of their work. Students may discuss written comments attached to their report with the marker during lab hours.
Reading list	N/A

Quality assurance

Date of first approval	
Date of last revision	
Date of this approval	
Module leader	James McGinty

Office use only

QA Lead	
Department staff	
Date of collection	
Date exported	
Date imported	

Notes/ comments	

Programme structure

Associated modules

UID	Legacy code	Module title	Requisite type
		First Year Laboratory (inc Python programming)	Prerequisite
		Second Year Laboratory	Prerequisite

Assessment details

		Pass mark
Grading method	Numeric	40%

Assessments

Assessment type	Assessment description	Weighting	Pass mark	Must pass?
			40%	
Practical	10 minute presentation and discussion - Cycle 1	25%	40%	N
Practical	2 page conference abstract - Cycle 2	25%	40%	N
Practical	6 page formal lab report - Cycle 3	50%	40%	N
		100%		