Imperial College London

Module Specification (Curriculum Review)

Basic details

UID		Cohorts covered	Earliest cohort: 2021-22	Latest cohort:

Long title: Practical physics: laboratory, computing and problem solving

New code: PHYS40001

New short title: Practical Physics

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

This module covers laboratory and computing plus more generic problem-solving skills. In laboratory, students are trained in a range of experimental techniques covering several areas of physics and are provided with guidance on best practice in dry laboratory safety, working with others, use of laboratory notebooks and basic planning and design of experiments. The principal focus of computing is to teach students how to code. Students learn the programming language Python, providing them with a numerical problem-solving toolset, data-representation skills and generic logic and analytical skills. Problem-solving focuses on training in making approximations, estimating orders of magnitude and tackling unfamiliar problems.

732 characters

Available as a standalone module/ short course? N

Statutory details

	ECTS	CATS	Non-credit
Credit value	10	20	N

FHEQ level: 4

HECOS codes:

Allocation of study hours

	Hours	
Lectures	5	
Group teaching	10	*Incl. seminars, tutorials, problem classes.*
Lab/ practical	95	
Other scheduled	0	*Incl. project supervision, fieldwork, external visits.*
Independent study	140	*Incl. wider reading/ practice, follow-up work, completion of assessments, revisions.*
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	Physics
Additional teaching departments	None
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		Stuart	Mangles
		Brian	Appelbe

Learning and teaching

Module description

Learning outcomes	On completion of this module you will be able to: 1) Demonstrate a practical familiarity with basic laboratory equipment found in mainstream physics laboratories and use the equipment to make basic measurements with the use of optical and basic electronic equipment. 2) Work with a lab partner to plan, design, write about and critically analyse the merits of basic, stand-alone laboratory experiments. 3) Write your own code in Python to produce analytical solutions to basic mathematical problems and use simple library routines to solve some more advanced problems. 4) Use Python to produce basic tables and graphs from raw sets of data. 5) Make order-of-magnitude estimations of solutions to unfamiliar and unstructured problems both in physics and outside of physics. 6) Use dimensional analysis to assist in solving unfamiliar and unstructured problems.
Module content	Laboratory and computing are intermixed, with computer skills taught in Python – how to display data, perform simple error analysis, call libraries and perform simple calculations – being used to support work by the students in laboratories. Laboratories themselves start with a three week introduction with simple, practical experiments designed to introduce new equipment, good working methods (keeping lab books, collaborating with partners and peers), and writing a journal-style lab report. This is followed by longer experiments with more freedom for students to organise their own time in the sessions. These experiments cover classical mechanics, optics and electromagnetism. Though there are links with the relevant modules in these disciplines, the laboratory sessions are standalone and can be carried out with A-Level knowledge. Problem solving builds somewhat on the open-ended nature of research highlighted in the laboratories. It provides a framework to aid students in breaking down difficult, often ill defined problems by critically examining the problem, then employing simple physics, dimensional analysis, estimation and order of magnitude calculations.

Learning and Teaching Approach

Laboratory and Computing: the bulk of the module usually sees students attending three-hour lab sessions supported by demonstrators plus two hours of independent lab session each week (typically 7 weeks in term 1 and 4 weeks in term 2). These are supplemented by three hour supported sessions on computing (typically 4 weeks in term 1) and data analysis (typically 11 2 hour sessions in term 1 and 2) and occasional lectures on introductory material, uncertainty analysis, the basics of computing and the laboratory report writing. Several demonstrators support each session. They are on hand to monitor progress and assist with any queries or student difficulties throughout the sessions.
Problem solving: this is taught in small group tutorials. The structure of the tutorials is at the discretion of the tutor but always based around a worksheet prepared by the module leader.

Assessment Strategy

Computing is assessed directly via a small coding project on data analysis. The code and output are graded pass/fail (and resubmission for fail).
In laboratory half of the grade is assessed through day-to-day performance in the laboratory, which includes assessment of the student's lab book record. The other half of the grade is assessed through laboratory reports (NB computing skills are also included as part of the experiments, with students using Python to help display and analyse data). Initial assessment of laboratory is carried out by individual demonstrators. The marks of demonstrators are moderated by the module lead. One formatively assessed report and two summatively assessed reports are submitted over Terms 1 and 2.
Problem solving assessment is by a test taken under exam conditions in Term 3, with students who do not pass this being assessed by viva or resit exam in September

Feedback

Formative feedback on real time progress is continual for laboratory and computing as demonstrators are on hand for the whole of the student contact time; they are proactive in providing advice and assistance. The first laboratory report does not carry any marks for degree course credit: it is assessed in the same way as the two subsequent exercises but only a mock grade is given. Students are provided with verbal and written feedback for this and for the summatively assessed hand-ins.

Reading list

The module is self contained and no additional books are required to be purchased by the students. Further discussion of material covered by the module, along with relevant problems can be found in:
• Practical Physics, G L Squires, 4th ed, Cambridge University Press, 2001
• Experimental Measurements: Precision, Error and Truth, N C Barford, 2nd ed, Wiley, 1985

Quality assurance

Date of first approval:
Date of last revision:
Date of this approval:

Module leader: Stuart Mangles

Notes/ comments:

Office use only

QA Lead:
Department staff:
Date of collection:

Date exported:
Date imported:

Assessment details

Grading method	Numeric	Pass mark	40%

Assessments

Assessment type	Assessment description	Weighting	Pass mark	Must pass?
Practical	Assessment of day-to-day work in the laboratory	30%	40%	Y
Coursework	Two laboratory reports	30%	40%	Y
Coursework	Computational submission	10%	100%	Y
Examination	Problem-solving test	30%	40%	Y

• 100%