Imperial College London

Module Specification (Curriculum Review)

Basic details

UID		Cohorts covered	Earliest cohort: 2024-25; Latest cohort:
Long title	Mechanics and Relativity		
New code	PHYS40002	New short title	Mechanics & Relativity

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

The purpose of this module is to provide you with a knowledge and understanding of the essentials of the mathematics and physics of motion in space and time. The module starts with classical mechanics: kinematics and Newton's laws of gravity and motion, including linear and rotational motion, conservation laws, inertial and non-inertial frames. Limitations to Newtonian mechanics are explored with a full introduction to Einstein's special theory of relativity. The necessary mathematics is fully integrated into the course. A series of lectures will help set the module and entire physics degree course in context by discussing major problems in our current understanding of physics.

686 characters

Available as a standalone module/ short course? N

Statutory details

	ECTS	CATS	Non-credit
Credit value	15	30	N

HECOS codes:

FHEQ level: 4

Allocation of study hours

	Hours	
Lectures	70	
Group teaching	24	*Incl. seminars, tutorials, problem classes.*
Lab/ practical	0	
Other scheduled	20	*Incl. project supervision, fieldwork, external visits.*
Independent study	261	*Incl. wider reading/ practice, follow-up work, completion of assessments, revisions.*
Placement		*Incl. work-based learning and study that occurs overseas.*
Total hours	375	
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		Jon	Fenton
Lecturer		Jon	Fenton
Lecturer		Zulfikar	Najmudin
Lecturer		Frank	Berkshire
Lecturer		Mitesh	Patel

Learning and teaching

Module description

Learning outcomes	On completion of this module you will be able to: 1) Use vector and matrices to solve systems of equations and demonstrate understanding of their application in classical mechanics. 2) Make use of the machinery of differential and integral calculus in solving problems: functions, limits, differentiation/integration, convergence/divergence of infinite series, series expansions and character of stationary points of functions of one and two independent variables, simple curve sketching. 3) Recall and appropriately apply Newton's three laws of motion and Newton's law of gravitation. 4) Describe the limitations of Newton's laws and explain when quantum mechanics, special relativity and general relativity become relevant. 5) State the fundamental postulates of special relativity and use them to solve problems in kinematics and dynamics at relativistic velocities. 6) Use the relativistic energy and momentum equations and appropriately interpret the results. 7) Demonstrate appreciation of the limitations in our current physical understanding of the world, and the ongoing research efforts that address this.

Module content	The mathematical content covers vectors, matrices, functions and calculus. The classical mechanics content covers, kinematics, Newton's laws of motion, forces and energy, Newton's law of gravity and central forces, solid body rotation and gyroscopic motion. The relativistic content covers Galilean relativity, non-inertial frames and special relativity. Major problems with our current understanding of physics will be explored. Through this, students will gain an introduction to the research areas in each of the major physics disciplines at Imperial - Astrophysics, Condensed/Cold matter, High Energy Physics, Materials, Photonics, Plasma Physics, Quantum optics, Space and Atmospheric Physics, Theoretical physics.
Learning and Teaching Approach	Students will be taught over three terms, but weighted towards the first term, using a combination of lectures, small group teaching, office hours, study groups and directed exercises on theoretical, practical and computational work. There will be no actual laboratory or computational classes written into the timetable. Each component of the module will have a kernel of core lecture material with other modes of delivery brought in around this central unit.
Assessment Strategy	The mathematical and classical mechanics content (learning objectives 1,2,3) are assessed by an exam at the start of term 2 along with term-1 in-course assessment including written problems. The exam also gives the students their first experience of exams within the physics department, and provides an ideal opportunity for feedback on both their progress and exam technique. For major problems with our current understanding of physics (learning objective 7) students will write a short review on a paper published in one of the research areas, summarising it and setting it in context - enabling them to practise library skills, referencing and summation. Relativity (learning objectives 4, 5, 6) will be assessed by in-course assessment including written problems and online exercises.
Feedback	Formative feedback will be provided throughout the module following formative assessment in the form of in-class quizzes, online tests, marking of handwritten problems sheets and verbal feedback for any practical or computational exercises. Feedback for any in-course continuous assessment will be provided within two weeks of the submission date. General feedback on written examinations for each module is provided in the form of written reports from the examiners for the students.
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: - Mathematical methods in the physical sciences (Boas) - Classical Mechanics (Kibble and Berkshire). - Newtonian Mechanics for Undergraduates (Tymms) - Sears and Zemansky's University Physics : with modern physics (Young and Freedman) - Classical Mechanics From Newton to Einstein: A Modern Introduction (McCall) - The Feynman lectures on Physics

Quality assurance

Date of first approval	
Date of last revision	
Date of this approval	
Module leader	Jonathan Fenton

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

Assessment details

		Pass mark
Grading method	Numeric	40%

Assessments

Assessment type	Assessment description	Weighting	Pass mark	Must pass?
Examination	2.5-hour written exam at the start of Term 2	70%		N
Coursework	Summary review (written article - approx 500 words)	3%		N
Coursework	Term 1 content (Mechanics & Maths) - In-course assessed written problems and online tests	12%		N
Coursework	Relativity - In-course assessed written problems and online tests	15%		N
		100%		