Imperial College London

Module Specification (Curriculum Review)

Basic details

			Earliest cohort	Latest cohort
UID		Cohorts covered	2023-24	

Long title: Mathematical Analysis

New code	PHYS40007	New short title	Mathematical Analysis

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

This module is intended to help students to think “like a mathematician” and to understand the mathematics underlying notions of limits and infinity with particular emphasis on the underpinnings of Calculus. Examples of physical contexts such as approximations using the Taylor series will illustrate the importance of these ideas in physics. Time will also be devoted to developing the ability to write rigorous proofs in these contexts.

438 characters

Available as a standalone module/ short course? N

Statutory details

	ECTS	CATS	Non-credit		
Credit value	5	10	N	HECOS codes	

FHEQ level: 4

Allocation of study hours

	Hours	
Lectures	21	
Group teaching	4	*Incl. seminars, tutorials, problem classes.*
Lab/ practical	0	
Other scheduled	12	*Incl. project supervision, fieldwork, external visits.*
Independent study	88	*Incl. wider reading/ practice, follow-up work, completion of assessments, revisions.*
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 2	Other	Exam in Term 3

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		Jonathan	Halliwell

Learning and teaching

Module description

Learning outcomes	On completion of this module, you will be able to: • Interpret, work with and apply the concepts of real numbers, counting and infinity • Make appropriate use of the rigorous definition of limits of sequences. • Make use of series, functions, limits, continuity and be able to describe the basis of Calculus • Interpret the Taylor series, and describe the sense in which it is an approximation in physics.
Module content	• Sets and maps: Sets, notation, methods of proof, Russell's paradox, maps • Numbers: Real numbers as infinite decimals, completeness of the reals, cardinality and countability, Cantor's 'diagonal' proof. • Sequences: Convergence using $\varepsilon - N$. Monotone and bounded sequences, sub-sequences, Bolzano-Weierstrass theorem. Cauchy sequences as convergent sequences. • Series: Convergence of a series, comparison test, Cauchy and other standard tests (eg. root, ratio, alternating). Power series. Riemann reordering. • Functions: Limits and continuity using $\varepsilon - \delta$. Differentiable and smooth functions. Taylor's theorem and analytic functions.
Learning and Teaching Approach	Students will be taught using a combination of lectures, small-group tutorial teaching, office hours and directed exercises.
Assessment Strategy	An exam in term 3 covering all learning outcomes will comprise the main part of the summative assessment and will contribute 100% of the module mark.
Feedback	Formative feedback will be provided orally within small-group tutorial classes. 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:
- K.E.Hirst, Numbers, Sequences and Series (London, Edward Arnold, 1995).
- G.Smith, Introductory Mathematics: Algebra and Analysis (Springer, 1998).
- M.Liebeck, A Concise Introduction to Pure Mathematics (Chapman and Hall, CRC, 2000).
- K.G. Binmore, Mathematical Analysis. A Straightforward Approach (Cambridge University Press, 1982).

Quality assurance

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

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?
			40%	
Examination	2-hour exam	100%	40%	N
		100%		