

MSci Physics with Theoretical Physics

This document provides a definitive record of the main features of the programme and the learning outcomes that a typical student may reasonably be expected to achieve and demonstrate if s/he takes full advantage of the learning opportunities provided. This programme specification is intended as a reference point for prospective students, current students, external examiners and academic and support staff involved in delivering the programme and enabling student development and achievement.

Programme Information

Award(s)	MSci		
Associateship	Royal College of Science		
Programme Title	Physics with Theoretical Physics		
Programme code	F390		
Awarding Institution	Imperial College London		
Teaching Institution	Imperial College London		
Faculty	Faculty of Natural Sciences		
Department	Department of Physics		
Mode and Period of Study	4 academic years full-time		
Cohort Entry Points	Annually in October		
Relevant QAA Benchmark Statement(s) and/or other external reference points	Physics, Astronomy and Astrophysics The Physics Degree (Institute of Physics)		
Total Credits	ECTS:	240	CATS: 480
FHEQ Level	Level 7		
EHEA Level	2 nd cycle		
External Accreditor(s)	Institute of Physics (IOP)		

Specification Details

Student cohorts covered by specification	2016/17 entry
Person responsible for the specification	Dr Robert Forsyth (DUGS)
Date of introduction of programme	2012-13 (date of last review)
Date of programme specification/revision	August 2016

Description of Programme Contents

The Physics degree programmes cover a common core over the first two years, including Mathematics, Mechanics, Vibrations & Waves, Electricity & Magnetism, Optics, Thermodynamics & Statistical Physics, Relativity, Quantum Physics, Atomic, Nuclear & Particle Physics, Solid State Physics, and laboratory work. A wide range of elective modules are available in Years 3 and 4 of the MSci programme allowing students to specialise in areas of advanced mathematics and theoretical physics up to Masters level standard (FHEQ Level 7). A substantial final year project is undertaken in association with one of the Department's research groups. The programme aims to prepare students for the transition to postgraduate study in physics or a career as a professional physicist.

Learning Outcomes

The Imperial Graduate Attributes are a set of core competencies which we expect students to achieve through completion of any Imperial College degree programme. The Graduate Attributes are available at: www.imperial.ac.uk/students/academic-support/graduate-attributes

Knowledge and Understanding of:

- The fundamentals, which all students need to cover, including electromagnetism, optics, quantum and classical mechanics, relativity, statistical physics and thermodynamics, wave phenomena and the properties of matter.
- The application of the fundamental principles to particular areas. These include nuclear and particle physics, condensed matter physics and atomic structure.
- A few subjects which students study in greater depth and appreciate current developments at the frontiers of the subject.
- Advanced mathematics and its application in physics.

Intellectual Skills

Students will learn how to:

- Formulate and tackle problems in physics, including the identification of appropriate physical principles and the use of special and limiting cases and order-of-magnitude estimates, to arrive at a solution which is presented with an explicit statement of assumptions and approximations.
- Use mathematics to describe the physical world, selecting appropriate equations, constructing models, interpreting mathematical results and critically comparing them with experiment and observation. This programme will additionally lead students to appreciate the use of rigour in mathematics.
- Participate, under supervision, in an extended physics investigation.

Practical Skills

Students will learn how to:

- Plan, execute and report the results of a complex extended experiment or investigation, using appropriate methods to analyse data and to evaluate the level of its uncertainty.
- Use appropriate software such as programming languages and packages in a physics investigation.

Transferable Skills

Students will learn how to:

- Solve open-ended problems and problems with well-defined solutions by formulating problems in precise terms, identifying key issues and trying different approaches in order to make progress.

- Carry out an independent investigation using textbooks and other available literature, searching databases and interacting with colleagues and staff to extract important information.
- Communicate effectively by listening carefully and presenting complex information in a clear and concise manner orally, on paper and using ICT.
- Use analytical skills, paying attention to detail and using technical language correctly, to manipulate precise and intricate ideas, and to construct logical arguments.
- Use ICT skills for communication and analysis.
- Work independently, use their initiative, meet deadlines, plan and execute a project.
- Work in groups, interacting constructively with others.

Entry Requirements

Academic Requirement

A*A*A or equivalent overall to include A* in Mathematics and A in Physics

Non-academic Requirements

Home and EU students will be invited to attend an interview; international students are dealt with on an individual basis

English Requirement

Grade B at GCSE or IELTS 6.5 with a minimum of 6.0 in each element or equivalent

The programme's competency standards documents can be found at:

<https://www.imperial.ac.uk/natural-sciences/departments/physics/students/current-students/student-welfare/>

Learning & Teaching Strategy

Scheduled Learning & Teaching Methods

- Lectures
- Tutorials
- Laboratory Classes
- Computing Labs
- Office hours

E-learning & Blended Learning Methods

- Support of lecture courses through online course materials and lecture recordings

Project and Placement Learning Methods

- Group and individual project work

Assessment Strategy

Assessment Methods

- Written Examination
- Assessed problem sheets
- Laboratory notebook
- Laboratory and project reports
- Essay
- Interview
- Group and individual presentations

Academic Feedback Policy

- All students receive feedback on their progress from their academic tutor in weekly tutorials.
- Assessed coursework in Years 1 and 2 is returned to students with comments within approximately one week of submission. Students may discuss their marks with their academic tutor if they wish.
- Laboratory and computing reports are returned to students normally within 2 weeks of submission and students have the opportunity of discussing their report with the marker if they wish. Heads of Laboratories are responsible for ensuring that feedback is prompt and effective
- Students are encouraged to discuss their examination performance with their Personal Tutor.

The College's Policy on Re-sits is available at: www.imperial.ac.uk/registry/exams/resit

The College's Policy on Mitigating Circumstances is available at: www.imperial.ac.uk/registry/exams

Assessment Structure

Marking Scheme

Year One

A student must:

- Achieve an aggregate mark of at least 40% in each element
- Achieve a mark of 65% in the Year 1 Mathematics module, otherwise a transfer into Year 2 of either the MSci (F303) or BSc (F300) programme is required

Year Two

A student must:

- Achieve an aggregate mark of at least 40% in each element
- Achieve an overall average mark of at least 60% to progress to Year 3 of the MSci programme, otherwise a transfer into Year 3 of the BSc (F300) programme is required

Year Three

A student must:

- Achieve an aggregate mark of at least 40% in each element

Year Four

A student must:

- Achieve an aggregate mark of at least 50% in each element

Final Degree Classifications

Third – a student must achieve an aggregate mark of 40%

Lower Second – a student must achieve an aggregate mark of 50%

Upper Second – a student must achieve an aggregate mark of 60%

First - a student must achieve an aggregate mark of 70%

Candidates who fall no more than 2.5% below the minimum mark for a higher honours classification shall be eligible for review of their final classification. This review will be at the discretion of the Board of Examiners and is usually available to students who have achieved the higher class in 50% or more of the total credits awarded for the programme weighted by year.

Year	% Year Weighting	Module	% Module Weighting
Year One	7.69%	Mathematics	25%
		Measurement and Uncertainty	0%
		Mechanics, Vibrations & Waves	13.33%
		Electricity & Magnetism, Relativity	12.5%
		Quantum Physics and Structure of Matter	12.5%
		Mathematical Analysis I	6.67%
		Laboratory and Computing I	15%
		Professional Skills and Basic Electronics I	8.33%
		Project	6.67%
Year Two	23.08%	Atomic, Nuclear and Particle Physics	10%
		Electromagnetism and Optics	15%
		Professional Skills II	3.33%
		Quantum Mechanics	10%
		Solid State Physics	8.33%
		Mathematics and Statistics of Measurement	15%
		Thermodynamics and Statistical Physics	11.67%
		Laboratory and Computing II	16.67%
		Mathematical Methods	10%
Year Three	30.77%	Element I: Core Physics, including Advanced Classical Physics, Fluid Dynamics, Light & Matter and Physics of the Universe	30%
		Element II: MSci Options between 24-27 ECTS from <i>elective groups A-G</i> <ul style="list-style-type: none"> • majority or all from group C • maximum of one each from groups A, D & F • maximum of one in total from groups B & E 	40%
		Element III: Comprehensive Physics and Professional Skills III	30%

Year	% Year Weighting	Module	% Module Weighting
Year Four	38.46%	Element I: Research Interfaces	13.33%
		Element II: MSci Project	36.67%
		Element III: MSci Options between 30-35 ECTS from <i>elective groups (B-E & G)</i> <ul style="list-style-type: none"> • <i>majority or all from group D</i> • <i>maximum of one in total from groups B, C, E & G</i> • <i>must have at least 30 ECTS from group D in degree</i> • <i>must have at least 36 ECTS with course codes beginning PT in degree</i> 	50%

Module List												
Code	Title	Core/Elective	Year	L&T Hours	Ind. Study Hours	Place-ment Hours	Total Hours	% Written Exam	% Course-work	% Practical	FHEQ Level	ECTS
PH1-MU	Measurement and Uncertainty	CORE	1	4	4	0	0	0%	0%	0%	4	0
MPH.1	Mathematics	CORE	1	142	233	0	375	85%	15%	0%	4	15
P1.1.1	Mechanics, Vibrations & Waves	CORE	1	72	128	0	200	85%	15%	0%	4	8
P1.2.1	Electricity & Magnetism, Relativity	CORE	1	64	123.5	0	187.5	85%	15%	0%	4	7.5
P1.3.1	Quantum Physics & Structure of Matter	CORE	1	73	114.5	0	187.5	85%	15%	0%	4	7.5
P1.5	Mathematical Analysis I	CORE	1	50	50	0	100	85%	15%	0%	4	4
PL1.1	Laboratory and Computing I	CORE	1	75	150	0	225	0%	50%	50%	4	9
P1.7	Professional Skills and Basic Electronics I	CORE	1	32	93	0	125	57%	43%	0%	4	5
PP1.1	Project	CORE	1	83	17	0	100	0%	50%	50%	4	4
P2.8	Atomic , Nuclear and Particle Physics	CORE	2	54	96	0	150	85%	15%	0%	5	6
P2.4	Electromagnetism & Optics	CORE	2	80	145	0	225	85%	15%	0%	5	9
P2.7	Professional Skills II	CORE	2	4	46	0	50	0%	100%	0%	5	2
P2.1	Quantum Mechanics	CORE	2	58	92	0	150	85%	15%	0%	5	6
P2.9	Solid State Physics	CORE	2	44	81	0	125	85%	15%	0%	5	5
P2.5	Mathematics & Statistics of Measurement	CORE	2	80	145	0	225	85%	15%	0%	5	9
P2.2	Thermodynamics & Statistical Physics	CORE	2	71	104	0	175	85%	15%	0%	5	7
PL2.1	Laboratory and Computing II	CORE	2	121	129	0	250	0%	50%	50%	5	10
MPh2	Mathematical Methods	CORE	2	57	93	0	150	100%	0%	0%	5	6
PO2.3	Environmental Physics	ELECTIVE (A)	3	47	103	0	150	100%	0%	0%	5	6
PO2.1	Sun, Stars & Planets	ELECTIVE (A)	3	49	101	0	150	100%	0%	0%	5	6

Module List												
Code	Title	Core/Elective	Year	L&T Hours	Ind. Study Hours	Place-ment Hours	Total Hours	% Written Exam	% Course-work	% Practical	FHEQ Level	ECTS
N/A	Imperial Horizons	ELECTIVE (B)	3	Various			150	Various				6
P.COMP12	Comprehensive Physics	CORE	3	20	380	0	400	100%	0%	0%	6	16
P3.4	Professional Skills III	CORE	3	4	46	0	50	0%	0%	100%	6	2
P3.12b	Fluid Dynamics	CORE	3	16	21.5	0	37.5	100%	0%	0%	6	1.5
P3.11	Light & Matter	CORE	3	53	97	0	150	100%	0%	0%	6	6
P3.12a	Physics of the Universe	CORE	3	41	71.5	0	112.5	100%	0%	0%	6	4.5
PP3.3	Physics Project	ELECTIVE (F)	3	90	135	0	225	0%	100%	0%	6	9
PEP3.1	Physics Essay III	ELECTIVE (F)	3	90	135	0	225	0%	100%	0%	6	9
PO3.4	Advanced Classical Physics	CORE	3	57	93	0	150	100%	0%	0%	6	6
PO3.6	Astrophysics	ELECTIVE (C)	3 or 4	47	103	0	150	100%	0%	0%	6	6
PO3.9	Communicating Physics	ELECTIVE (G)	3 or 4	45	105	0	150	0%	100%	0%	6	6
PT3.6	Complexity & Networks	ELECTIVE (C)	3 or 4	57	93	0	150	20%	80%	0%	6	6
PT3.5	Computational Physics	ELECTIVE (C)	3 or 4	58	92	0	150	40%	60%	0%	6	6
PT3.1	Foundations of Quantum Mechanics	ELECTIVE (C)	3 or 4	57	93	0	150	100%	0%	0%	6	6
PT3.2	Group Theory	ELECTIVE (C)	3 or 4	57	93	0	150	100%	0%	0%	6	6
PO3.3a	Lasers	ELECTIVE (C)	3 or 4	28.5	46.5	0	75	100%	0%	0%	6	3
PO3.3b	Imaging & Biophotonics	ELECTIVE (C)	3 or 4	28.5	46.5	0	75	100%	0%	0%	6	3
PO3.7a	Medical Imaging: X-Rays & Ultrasound	ELECTIVE (C)	3 or 4	23.5	51.5	0	75	100%	0%	0%	6	3
PO3.7b	Medical Imaging: Nuclear Diagnostics & MRI	ELECTIVE (C)	3 or 4	23.5	51.5	0	75	100%	0%	0%	6	3
PO3.2	Plasma Physics	ELECTIVE (C)	3 or 4	47	103	0	150	100%	0%	0%	6	6

Module List												
Code	Title	Core/Elective	Year	L&T Hours	Ind. Study Hours	Place-ment Hours	Total Hours	% Written Exam	% Course-work	% Practical	FHEQ Level	ECTS
PO3.5	Principles of Instrumentation	ELECTIVE (C)	3 or 4	58	92	0	150	80%	20%	0%	6	6
PT3.4	Statistical Mechanics	ELECTIVE (C)	3 or 4	57	93	0	150	100%	0%	0%	6	6
PT4.1	Advanced Particle Physics	ELECTIVE (D)	3 or 4	57	93	0	150	100%	0%	0%	7	6
PO4.1	Atmospheric Physics	ELECTIVE (D)	3 or 4	57	93	0	150	100%	0%	0%	7	6
BE4-MCNS	Computational Neuroscience	ELECTIVE (D)	3 or 4	57	93	0	150	100%	0%	0%	7	6
PO4.10	Nanotechnology in Consumer Electronics	ELECTIVE (D)	3 or 4	23.5	51.5	0	75	100%	0%	0%	7	3
PT4.2	General Relativity	ELECTIVE (D)	3 or 4	57	93	0	150	100%	0%	0%	7	6
PO4.9	Advanced Hydrodynamics	ELECTIVE (D)	3 or 4	23.5	51.5	0	75	100%	0%	0%	7	3
PH4-LT	Laser Technology	ELECTIVE (D)	3 or 4	47	103	0	150	100%	0%	0%	7	6
PO4.4a	Optical Communications	ELECTIVE (D)	3 or 4	23.5	51.5	0	75	100%	0%	0%	7	3
PO4.4b	Information Theory	ELECTIVE (D)	3 or 4	23.5	51.5	0	75	100%	0%	0%	7	3
PO4.9	Plasmonics & Metamaterials	ELECTIVE (D)	3 or 4	47	103	0	150	100%	0%	0%	7	6
PT4.4	Quantum Field Theory	ELECTIVE (D)	3 or 4	57	143	0	200	100%	0%	0%	7	8
PT4.8	Quantum Information	ELECTIVE (D)	3 or 4	57	93	0	150	100%	0%	0%	7	6
PO4.6	Quantum Optics	ELECTIVE (D)	3 or 4	47	103	0	150	100%	0%	0%	7	6
PT4.5	Quantum Theory of Matter	ELECTIVE (D)	3 or 4	57	93	0	150	100%	0%	0%	7	6
PO4.5	Cosmology	ELECTIVE (D)	3 or 4	57	93	0	150	100%	0%	0%	7	6
PO4.3	Space Physics	ELECTIVE (D)	3 or 4	47	103	0	150	100%	0%	0%	7	6
PT4.6	Unification	ELECTIVE (D)	3 or 4	57	143	0	200	100%	0%	0%	7	8
N/A	Business for Professional Engineers & Scientists	ELECTIVE (E)	3 or 4	Various			150	Various			6	

Module List												
Code	Title	Core/Elective	Year	L&T Hours	Ind. Study Hours	Place-ment Hours	Total Hours	% Written Exam	% Course-work	% Practical	FHEQ Level	ECTS
PRI	Research Interfaces	CORE	4	50	150	0	200	0	85	15	7	8
PRJ4	MSci Project	CORE	4	1	549	0	550	0	100	0	7	22

Supporting Information

The Programme Handbook is available at: <http://www.imperial.ac.uk/natural-sciences/departments/physics/students/current-students/undergraduates/physics-student-handbook/>

The Module Handbook is available at: <https://www.imperial.ac.uk/natural-sciences/departments/physics/students/current-students/undergraduate-and-masters-degree-courses-list/>

The College's entry requirements for undergraduate programmes can be found at: www.imperial.ac.uk/study/ug/apply/requirements/

The College's Quality & Enhancement Framework is available at: www.imperial.ac.uk/registry/proceduresandregulations/qualityassurance

The programme is consistent with the Qualifications Framework of the European Higher Education Area which is available at: <http://www.ehea.info/Uploads/qualification/QF-EHEA-May2005.pdf>