

MSci Physics with Science Education

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	QTS	
Associateship	Royal College of Science		
Programme Title	Physics		
Programme code	F3XD		
Awarding Institution	Imperial College London for the MSci National College of Teaching and Leadership (NCTL) for Qualified Teacher Status (QTS) on the recommendation of Canterbury Christ Church University (CCCU)		
Teaching Institution	Imperial College London Canterbury Christ Church University (CCCU)		
Faculty	Faculty of Natural Sciences (Imperial) Faculty of Education (CCCU)		
Department	Department of Physics School of Teacher Education and Development (CCCU)		
Mode and Period of Study	4 academic years full-time		
Cohort Entry Points	Annually in June – Student enrol on the BSc in Physics (F300) or MSci in Physics (F303) in the first instance transferring to the MSci in Physics with Science Education at the end of Year 2		
Relevant QAA Benchmark Statement(s) and/or other external reference points	Physics, Astronomy and Astrophysics The Physics Degree (Institute of Physics) The relevant professional standards for teaching		
Total Credits	ECTS:	240	CATS: 480
FHEQ Level	Level 7		

EHEA Level	2 nd cycle
External Accreditor(s)	Institute of Physics (IOP) and the National College of Teaching and Leadership for the award of Qualified Teacher Status.
Specification Details	
Student cohorts covered by specification	2016/17 entry
Person responsible for the specification	Dr Robert Forsyth (DUGS)
Date of introduction of programme	October 2015
Date of programme specification/revision	August 2016
Description of Programme Contents	
<p>The MSci in Physics with Science Education aims to educate students in the core of physics, including substantial practical and experimental physics while enabling students to train in both the theoretical and practical aspects of secondary school teaching. The programme leads to a integrated master's degree from Imperial College London and a recommendation for Qualified Teacher Status (QTS) from Canterbury Christ Church University (CCCU), a leader in innovative teacher education programmes.</p> <p>The Department's 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 receive a broad physics education or specialise in particular areas of 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.</p> <p>The programme includes three modules taught and assessed by CCCU as well as 140 days of teacher training school placements organised by CCCU. Apart from the school placements, the programme takes place at Imperial College London, South Kensington campus.</p>	
Learning Outcomes	
<p>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</p>	
<p>Knowledge and Understanding of:</p> <ul style="list-style-type: none"> • 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. • The principles and practice of teaching physics, and other sciences to secondary school pupils. 	

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.
- Participate, under supervision, in an extended physics investigation.
- Plan sequences of lessons appropriate for the age of pupils to be taught.

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.
- Facilitate the learning of a group of secondary school pupils through the maintenance of a purposeful and safe learning environment.

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.
- Communicate with school pupils in a manner appropriate to their age.

Entry Requirements

Academic Requirement	A*A*A or equivalent overall to include A* in Mathematics and A in Physics
Non-academic Requirements	Applicants must meet the current government requirements for entry to teaching currently including GCSE grades and QTS skills tests. Applicants will need to be assessed as fit to teaching, including occupational health and Disclosure and Barring Service (DBS), according to the current government requirements.

Students wishing to apply should express an interest in the programme in their first year and prior to starting the Communicating Physics module in Year 2 which is used as a precursor to the programme. All applicants for the Communicating Physics module will be interviewed by staff from both Imperial and CCCU. Performance in the Communicating Physics module will be assessed by Imperial and successful candidates will then be interviewed by Imperial and CCCU staff to ensure suitability to teach. Performance in the Communicating Physics module and the outcome of the interview will determine whether a student can transfer to the MSci in Physics with Science Education.

English Requirement	Grade B at GCSE or IELTS 6.5 with a minimum of 6.0 in each element or equivalent
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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	<ul style="list-style-type: none"> • Lectures • Tutorials • Laboratory Classes • Computing Labs • Office hours
E-learning & Blended Learning Methods	<ul style="list-style-type: none"> • Support of lecture courses through online course materials and lecture recordings
Project and Placement Learning Methods	<ul style="list-style-type: none"> • Group and individual project work • 140 days spent on teacher training placements

Assessment Strategy

Assessment Methods	<ul style="list-style-type: none"> • Written Examination • Assessed problem sheets • Laboratory notebook • Laboratory and project reports • Essay • Interview • Group and individual presentations • Reflective portfolio – portfolios are collections of academic work. They may contain a written essay or reflection alongside a main practical/presentation/performance element.
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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.
- CCCU regulations determine that feedback on all assessed elements of the education modules (CSI, CSII and PS) is presented to students within 15 working days.

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

[Award of Qualified Teacher Status](#)

At the discretion of the CCCU Board of Examiners and in consultation with Imperial, students failing to meet the requirements for the award of QTS at the first attempt may be provided with a further opportunity for teaching practice after the final year examinations.

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

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 a BSc (either F300 or F3XC) 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.

Award of Qualified Teacher Status

The teaching placements meet the current requirements for Initial Teacher Education (ITE) programmes set by government, and will be assessed according to current Ofsted criteria. Academic credit is not awarded directly for teaching placements. This is in order to allow a student who did not meet the requirements to gain QTS to still gain an academic degree. Instead, the academic credits are gained through assignments and portfolios which reflect upon teaching placements, and draw upon research and literature in education and as such the academic work is still linked directly to teaching practice, without being fully dependent upon success in that practice. The CCCU Board of Examiners will determine whether Qualified Teacher Status (“QTS”) should be recommended to the National College for Teaching and Leadership (NCTL).

A student who passes all academic parts of the programme but fails to achieve Qualified Teacher Status will still be awarded the MSci in Physics with Science Education.

Year	% Year Weighting	Module	% Module Weighting
Year One	7.69%	Measurement and Uncertainty	0%
		Laboratory and Computing I	15%
		Professional Skills and Basic Electronics I	8.33%
		Electricity & Magnetism, Relativity	12.5%
		Mathematics	25%
		Mechanics, Vibrations & Waves	13.33%
		Quantum Physics and Structure of Matter	12.5%
		Project	6.67%
		Advanced Electronics	6.67%
Year Two	23.08%	Professional Skills II	3.33%
		Quantum Mechanics	10%
		Solid State Physics	8.33%
		Atomic , Nuclear and Particle Physics	10%
		Mathematics and Statistics of Measurement	15%
		Thermodynamics and Statistical Physics	11.67%
		Laboratory and Computing II	16.67%
		Electromagnetism and Optics	15%
		Communicating Physics	10.00%
Year Three	30.77%	Curriculum Studies I	16.67%
		Curriculum Studies II	16.67%
		Professional Studies	16.67%
		Physics III for Educators: up to 12 ECTS of FHEQ Level 6 Physics Options (Electives A or C) plus either Physics Essay III or Physics Project III (Electives F)	20.00%
		Comprehensive Physics and Professional Skills III	30.00%
		110 days of teacher training placements (Pass/Fail)	0.00%

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-D</i> <ul style="list-style-type: none"> • majority or all from group D • maximum of 6 ECTS in total from groups B or C • must have at least 30 ECTS from group D in degree 	50%
		30 days of teacher training placements (Pass/Fail)	0.00%

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	8
P1.3.1	Quantum Physics & Structure of Matter	CORE	1	73	114.5	0	187.5	85%	15%	0%	4	8
P1.8	Advanced Electronics	CORE	1	47	53	0	100	0%	100%	0%	4	4
PL1.1	Laboratory and Computing I	CORE	1	75	150	0	225	0%	50%	50%	4	9
P1.4	Professional Skills I	CORE	1	32	93	0	100	57%	43%	0%	4	4
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
PO3.9	Communicating Physics	CORE	2	45	105	0	150	0%	100%	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
MPh2	Mathematical Methods	ELECTIVE (A)	3	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
N/A	Imperial Horizons	ELECTIVE (B)	4	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	ELECTIVE (C)	3 or 4	16	21.5	0	37.5	100%	0%	0%	6	1.5
P3.11	Light & Matter	ELECTIVE (C)	3 or 4	53	97	0	150	100%	0%	0%	6	6
P3.12a	Physics of the Universe	ELECTIVE (C)	3 or 4	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
PT3.5	Computational Physics	ELECTIVE (C)	3 or 4	58	92	0	150	40%	60%	0%	6	6
PO3.4	Advanced Classical Physics	ELECTIVE (C)	3 or 4	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
PT3.6	Complexity & Networks	ELECTIVE (C)	3 or 4	57	93	0	150	20%	80%	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 &	ELECTIVE (C)	3 or 4	23.5	51.5	0	75	100%	0%	0%	6	3

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
	Ultrasound											
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
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

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
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 (B)	4	Various			150	Various				6
CSI	Curriculum Studies I (CCCU)	CORE	3	60	190	See below	250	0%	100%	0%	6	10
CSII	Curriculum Studies II (CCCU)	CORE	3	55	195	See below	250	0%	100%	0%	7	10
PS	Professional Studies (CCCU)	CORE	3	41	209	See Below	250	0%	100%	0%	7	10
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

MSci Physics with Science Education Teacher Training Placements			
Timing	Teaching Placement	Associated Module	Level
June-July after Year 2 examinations	25 days in School 1	Curriculum Studies 1 – portfolio reflecting upon subject pedagogy.	6
September-December of Year 3	55 days in School 2	Professional Studies – portfolio on whole school issues.	7
June-July after Year 3 examinations	30 days in School 2	Curriculum Studies 2 – portfolio reflecting on specific issues of subject pedagogy.	7
June-July after Year 4 examinations	30 days in School 2 or 3		

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/>

Programme Management

CCCU appoints a member of academic staff for each education module and the teacher training placements who will act as the first point of contact (CCCU Co-ordinator) for students in all matters relating to welfare teaching and the curriculum. This is in addition to the welfare and teaching support provided by Imperial. CCCU Co-ordinator(s) is invited to attend Imperial's programme and departmental management meetings as appropriate. The CCCU Co-ordinator(s) is also a member of Imperial's Board of Examiners for the BSc award.

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

Quality Assurance

The programme is quality assured by Imperial. 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>

Regulations

Except where agreed otherwise under the terms of the Imperial and CCCU Memorandum of Agreement BSc in Physics with Science Education students will be required to comply with the Academic Regulations and other Regulations of Imperial at all times during the programme.

The teacher training placements are subject to the rules and procedures of CCCU, as set out in the Undergraduate Initial Teacher Education Scheme.

If an appeal or academic offence or complain relates solely to a CCCU education module this will be considered in consultation with CCCU. If an appeal or academic offence relates solely to the teacher training placement, this will be considered by CCCU in consultation with Imperial in accordance with the CCCU's Regulation and Credit Framework for the Conferment of Awards. In the case of professional misconduct whilst on the teacher training placement the case will be dealt with by CCCU in consultation with Imperial, according to CCC's Student Disciplinary Procedures for Professional Suitability Procedures. Cases of unsatisfactory progress with respect solely to the teacher training placement will be dealt with by CCCU in consultation with Imperial.

Governance and Regulation

Imperial College is an independent corporation whose legal status derives from a Royal Charter granted under Letters Patent in 1907. In 2007 a Supplemental Charter and Statutes was granted by

HM Queen Elizabeth II. This Supplemental Charter, which came into force on the date of the College's Centenary, 8th July 2007, established the College as a University with the name and style of "The Imperial College of Science, Technology and Medicine".

<http://www.imperial.ac.uk/admin-services/secretariat/college-governance/charters-statutes-ordinances-and-regulations/>

For information on CCCU see:

<https://www.canterbury.ac.uk/about-us/structure-and-governance/structure-and-governance.aspx>

Both Imperial College London and Canterbury Christ Church University are regulated by the Higher Education Funding Council for England (HEFCE)

<http://www.hefce.ac.uk/reg/register/>