

MSc Theory and Simulation of Materials

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

Programme Title	Theory and Simulation of Materials		
Award(s)	MSc		
Programme Code	F3U5	F3U52 [1+3]	
Associateship	None		
Awarding Institution	Imperial College London		
Teaching Institution	Imperial College London		
Faculty	Faculty of Natural Sciences		
Department	Department of Physics		
Mode and Period of Study	1 academic year, full-time		
Cohort Entry Points	Annually in October		
Relevant QAA Benchmark Statement(s) and/or other external reference points	Master's Awards in Physics, Astronomy and Astrophysics		
Total Credits	ECTS:	90	CATS: 180
FHEQ Level	Level 7		
EHEA Level	2 nd cycle		
External Accreditor(s)	None		
Specification Details			
Student cohorts covered by specification	2016-17 entry		
Person responsible for the specification	Dr Arash Mostofi		
Date of introduction of programme	October 2009		
Date of programme specification/revision	March 2017		

Description of Programme Contents

The Department of Physics is leading an interdisciplinary [Centre for Doctoral Training \(CDT\) on Theory and Simulation of Materials](#).

The Centre offers a four-year PhD, the first year of which leads to an MSc. Self-funded students may take the MSc by itself as a 12-month full-time course.

This course is aimed at mathematically talented students who relish theoretical and computational treatments of condensed matter that are relevant to major issues facing society today, such as energy supply, global warming, health and security.

It provides a foundation in the theoretical physics of materials and its application in simulations across different length and time scales to problems of technological importance.

With strong links to industry, other leading academic institutions, and government labs in the UK and overseas, there are plenty of opportunities to engage with external organisations, including collaborative research projects.

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 fundamental laws and principles of the physics and simulation of materials; along with their application (some at the forefront of the discipline);
- Research skills training which might include advanced problem solving, numerical techniques, writing software;
- How to use advanced mathematical and computational tools to describe the physical world;
- How to research and provide a lucid and critical summary of the scientific literature in a given topic of study;
- How to plan, execute and report the results of an extended theoretical and/or computational project.

Intellectual Skills

- Apply knowledge of physical principles and mathematical techniques to practical problems;
- Use mathematical and computational techniques to develop and solve physical models of materials;
- Demonstrate the ability to plan, undertake, and report on a programme of original work; including the planning and development of theoretical and/or computational models of complex structures, properties and processes in materials, the analysis and interpretation of experimental results, and validation of the models involved;
- Research and examine critically the scientific literature.

Practical Skills

- Write, test and debug programs in a Linux-based professional computing environment;
- Generate, visualise and analyse computational data, determine their validity, and make recommendations;

- Prepare technical reports;
- Deliver technical presentations;
- Use the scientific literature effectively.

Professional Skills Development

- Problem-solving skills;
- Investigative skills;
- Communication skills;
- Analytical skills;
- IT skills;
- Personal skills, including team-working.

Entry Requirements

Academic Requirement	A first class (1st) Honours degree in physical sciences or engineering.
Non-academic Requirements	None
English Language Requirement	Standard requirement

The programme's competency standards documents can be found at:
<http://www.imperial.ac.uk/natural-sciences/departments/physics/students/current-students/taught-postgraduates/>

Learning & Teaching Strategy

Scheduled Learning & Teaching Methods	<ul style="list-style-type: none"> • Lectures • Problem classes • Computational work • E-learning • Tutorials • Practical classes
E-learning & Blended Learning Methods	<ul style="list-style-type: none"> • Blackboard
Project and Placement Learning Methods	<ul style="list-style-type: none"> • Self-study project

Assessment Strategy

Assessment Methods	<ul style="list-style-type: none"> • Written examination • Coursework • Written report • Presentation • Oral presentation • Viva • Dissertation
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Academic Feedback Policy

The feedback policy will follow the guidelines of the Department of Physics, where written feedback should be provided to the student within two weeks of the work being submitted.

Many of the lecture modules have rapid feedback classes, which allow students to work through problems under the guidance of the lecturer.

Re-sit Policy

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

Mitigating Circumstances Policy

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

Programme Structure

Full-time	Pre-session	Autumn Term	Spring Term	Summer Term	Summer Vacation
Core Modules (Lectures)	0	6	2	0	0
Core Modules (Practical)	0	0	0	0	0
Elective Modules	0	0	2	0	0
Projects	0	0	1	1	0

Assessment Dates & Deadlines

Written Examinations	January
Coursework Assessments	Continuous
Project Deadlines	September
Practical Assessments	Continuous

Assessment Structure

Marking Scheme

The MSc consists of two elements:

- Taught modules, accounting for 60% of the total programme mark, and
- Research element, accounting for 40% of the total programme mark.

The marking scheme for the elements and components will follow the 'Regulations for the Examinations of Masters Degrees'

Pass - a candidate must:

- Achieve an aggregate mark of 50% or higher in each element;
- Pass each component with a mark of 40% or higher.

Merit - a candidate must:

- Achieve an aggregate mark of $\geq 60\%$ or higher in each element.
- Where appropriate, a Board of Examiners may award a result of merit where a candidate has achieved an aggregate mark of 60% or greater across the programme as a whole AND has obtained a mark of 60% or greater in each element with the exception of one element AND has obtained a mark of 50% or greater in this latter element.

Distinction - a candidate must:

- Achieve an aggregate mark of $\geq 70\%$ or higher in each element.
- Where appropriate, a Board of Examiners may award a result of distinction where a candidate has achieved an aggregate mark of 70% or greater across the programme as a whole AND has obtained a mark of 70% or greater in each element with the exception of one element AND has obtained a mark of 60% or greater in this latter element.

Module Weightings		
Element (% Weighting)	Module	% Module Weighting
Taught (60%)	Mathematics for Theory of Materials	14.81%
	Equilibrium in Materials	7.40%
	Transformation of Materials	7.40%
	Classical Field Theory of Materials	7.40%
	Electronic Structure of Materials	7.40%
	Methods for Simulating Materials	14.81%
	Computational Methods for Materials	11.11%
	Group Project	14.81%
	2 x elective modules	7.40% each
Research (40%)	Literature Review	25%
	Research Project	75%

Indicative Module List											
Code	Title	Core/ Elective	L&T Hours	Ind. Study Hours	Place- ment Hours	Total Hours	% Written Exam	% Course- work	% Practical	FHEQ Level	ECTS
PH9-TMTM	Mathematics for Theory of Materials	Core	32	168	0	200	80%	20%	0%	7	8
PH9-TCFTM	Classical Field Theory of Materials	Core	20	80	0	100	80%	20%	0%	7	4
PH9-TEQM	Equilibrium in Materials	Core	20	80	0	100	80%	20%	0%	7	4
PH9-TESM	Electronic Structure of Materials	Core	20	80	0	100	80%	20%	0%	7	4
PH9-TTM	Transformation of Materials	Core	20	80	0	100	80%	20%	0%	7	4
PH9-TMSM	Methods of Simulating Materials	Core	32	168	0	200	0%	70%	30%	7	8
PH9-TCOMM	Computational Methods	Core	26	124	0	150	0%	89%	11%	7	6
PH9-TGRSP	Group Project	Core	10	190	0	200	0%	66.7%	33.3%	7	8
PH9-TPRJ	Literature Review	Core	0	175	0	175	0%	100%	0%	7	9
PH9-TCFTM	Classical Field Theory of Materials - Advanced	Elective	8	92	0	100	0%	50%	50%	7	4
PH9-TEQM	Equilibrium in Materials – Advanced	Elective	8	92	0	100	0%	50%	50%	7	4
PH9-TESM	Electronic Structure of Materials – Advanced	Elective	8	92	0	100	0%	50%	50%	7	4
PH9-TTM	Transformation of Materials – Advanced	Elective	8	92	0	100	0%	50%	50%	7	4

Indicative Module List											
Code	Title	Core/ Elective	L&T Hours	Ind. Study Hours	Place- ment Hours	Total Hours	% Written Exam	% Course- work	% Practical	FHEQ Level	ECTS
PH9-TPRJ	Research Project	Core	0	675	0	675	0%	80%	20%	7	27

Supporting Information

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

The Module Handbook is available at: <http://www.imperial.ac.uk/natural-sciences/departments/physics/students/current-students/taught-postgraduates/>

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

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

The College's Academic and Examination Regulations can be found at: <http://www3.imperial.ac.uk/registry/proceduresandregulations/regulations>

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

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