MRes Molecular Engineering

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 primarily intended as a reference point for academic and support staff involved in delivering the programme and enabling student development and achievement, for its assessment by internal and external examiners, and in subsequent monitoring and review.

Programme Information				
Programme Title	Molecular Engineering			
Award(s)	MRes			
Programme Code	H803			
Awarding Institution	Imperial College London			
Teaching Institution	Imperial College London			
Faculty	Faculty of Engineering			
Department	Department of Chemical Engineering			
Associateship	N/A			
Mode and Period of Study	1 calendar year full-time (12 months)			
Cohort Entry Points	Annually in October			
Relevant QAA Benchmark Statement(s) and/or other external reference points	Master's Awards in Engineering Master's Awards in Chemistry Master's Awards in Physics			
Total Credits	ECTS:	90	UK Credits:	180
FHEQ Level	Level 7			
EHEA Level	2nd cycle			
External Accreditor(s)	None			
Specification Details				
Student cohorts covered by specification	2021-22 entry			
Person Responsible for the specification	Dr Niall Mac Dowell and Dr Koon-Yang Lee			
Date of introduction of programme	October 2017			
Date of programme specification/revision	October 2021			

Programme Overview

The MRes will enhance the students' ability for collaboration, and broaden understanding and communication in molecular science and engineering. At the beginning of the programme, bespoke introductory modules will be used to provide firm grounding at the interface of science and engineering (focused on mathematics, chemistry, physical sciences and engineering principles). Once a common basis has been achieved, students will engage in advanced activities cutting across engineering and natural sciences. Entrepreneurship and handling data, professional skills and graduate attributes will be embedded into all modules. Students will be able to exercise their broadened fundamental knowledge to a wide range of applied and industrial problems, providing opportunities to hone these skills through research projects with an industrial partner and cross-faculty at Imperial.

The focus of this programme is on the interaction of the subjects of molecular science and engineering, and as such, we expect most students will have experience and ability in chemistry, molecular science and engineering. However, given that this is a new course on the interface between molecular science and engineering we do not want to exclude exceptional students who are not equally experienced in all three disciplines but who can clearly show they are capable of appropriately engaging at this interface. While we expect most students to have the appropriate background in chemistry and molecular science, those who are less proficient in one area but who are likely to be able to successfully engage with this course will be admitted and supported through blended learning and pre-reading.

The programme's unique selling points are its trans-disciplinarity across science and engineering, and the exposure to broad industrial sectors. It will build on Imperial's strengths and reputation in transferring fundamental research advances into solutions to real-world problems, seeing research through to application. By coordinating Imperial's well-established links to industry, students will be provided with unprecedented access to companies to engage in applied research projects.

<u>Outputs</u>

The outputs of the Molecular Sciences and engineering MRes programme are:

- A bespoke group of high-quality prospective PhD candidates in broad areas of Molecular Science and Engineering.
- Postgraduate students with enhanced job prospect opportunities in industry.
- High-quality research evidenced by publication-grade short papers/articles/conference papers.

Learning Outcomes

On successfully completing this programme, students will be able to:

- Critically review how key scientific fundamentals (molecular description, spectroscopy, analytical techniques etc.) interrelate with an engineering perspective (systems analysis and design at different scales, statistics and systems modelling, materials across scales etc.).
- Appreciate and demonstrate the synergies in fundamental molecular science and engineering principles and their relationship in tackling industrially relevant applications.
- Use an evidence-based approach to solve complex design problems, applying concepts in optimisation and machine learning, and demonstrating an understanding of the relation between experiments, models and design with computer-aided approaches.
- Explain key aspects of selected manufacturing processes, and show the differences between scale-up/scale-out and the role of molecular level attributes in the process performance.

- With the use of specific examples and case studies, demonstrate the application of molecular modelling of matter from the atomic/molecular scale through to the plant process scale, explain specific areas of modern synthetic chemistry relevant to device design, and select characterisation methods appropriate for specific length and time scales, critically appraising how this modelling, making and measurement can be applied holistically in an engineering context.
- Apply their knowledge of Molecular Science and Engineering within a relevant practical industrial context (during a 3-month research project placement with an industrial partner) to effectively communicate with professional partners and produce appropriate briefings, reports and presentations.
- Formulate appropriate trans-disciplinary research plans, perform appropriately supported independent research and produce appropriate publication-level oral and written communication of their research during a subsequent 3-month research project at Imperial to follow on from the industrial placement.

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

Entry Requirements	
Academic Requirement	A UK Bachelor's Degree with Honours at 2:1 or equivalent in an engineering or physical sciences discipline which includes some mathematics.
Additional Requirements	None
Home/EU/international students will be invited to attend a post-application interview.	
English Language Requirement	IELTS 6.5 with a minimum of 6.0 in each element or equivalent
The programme's competency standards document is available at: TBC	
Learning & Teaching Strategy	
Scheduled Learning & Teaching Methods	• Lectures • Guided practical classes and laboratory work • Group exercises • Tutorials • Presentations • Individual research projects
E-learning & Blended Learning Methods	• On-line lecture materials • On-line groups/discussions
Project and Placement Learning Methods	• Research project
Placement Learning Methods	• Research projects may be co-supervised with industry partners

Assessment Strategy	
Assessment Methods	• Mastery examinations • Written examinations • Design brief • Group and individual presentations • Manufacturing project • Mini projects • Laboratory assessments • Problem sheets • Research proposal • Executive summary • Progress reports • Short report • Research article
Academic Feedback Policy	
Our policy is that all students receive feedback on assessed work within 2 weeks of submission. In the case of unforeseen circumstances where a 2-week turnaround is not possible, students will be advised at the earliest opportunity and provided with a revised date for feedback.	
Re-sit Policy	
Students who fail part of the taught component and/or the research component may be allowed to re-enter the following year, at the discretion of the examiners. Following the preliminary exam board, students who have to re-sit one or two modules may be given the option to re-sit these modules later in the year. Students with a large number of re-sits (usually three or above) will have to return to sit the exams the following year, during the normal exam period. Re-sit marks will be capped at the pass mark of 50%.	
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	Term One	Term Two	Term Three	Term Four
Core Modules	0	6	1	0	0
Projects	0	0	0	1	

Assessment Dates & Deadlines	
Written Examinations	January, February
Coursework Assessments	Continuous
Project Deadlines	September
Practical Assessments	Continuous

Assessment Structure		
Module	ECTS	% Weighting
Underpinning Molecular Science	5	Pass/Fail
Fundamentals of Molecular Engineering	5	Pass/Fail
Design of Molecular Systems	5	8%
Manufacturing Processes	5	8%
Multiscale Modelling – Understanding, Visualising, and Predicting	5	8%
Measuring – Analysis and Characterisation	5	8%
Making – Synthesis of Polymeric Systems	5	8%
Research Project	55	60%
Total	**90**	**100%**

Marking Scheme

Fail: any students whose average of any element falls below 50% or who achieved a mark below 40% in an individual examination will be reported as having failed.

Pass

A student must:

- Achieve a Pass in each Pass/Fail module or complete remedial work in that module
- Achieve a mark of at least 40% in each assessment
- Achieve a pass mark of 50% or greater in each module (students may be condoned in up to one module with an aggregate mark of 40%)
- Achieve an aggregate mark of 50% in the research project
- Achieve an overall aggregate mark of at least 50% for the programme

Merit

A student must:

- Achieve a Pass in each Pass/Fail module or complete remedial work in that module
- Achieve a mark of at least 40% in each assessment
- Achieve a pass mark of 50% or greater in each module (students may be condoned in up to one module with an aggregate mark of 40%)
- Achieve an aggregate mark of 60% in the research project
- Achieve an overall aggregate mark of at least 60% for the programme

Distinction

A student must:

- Achieve a Pass in each Pass/Fail module or complete remedial work in that module
- Achieve a mark of at least 40% in each assessment
- Achieve a pass mark of 50% or greater in each module (students may be condoned in up to one module with an aggregate mark of 40%)

- Achieve an aggregate mark of at least 70% in the research project
- Achieve an overall aggregate mark of at least 70% for the programme

Students should only be considered for **promotion** to Pass, Merit or Distinction if their aggregate mark across the programme and their Research Project mark are within 2.5% of the relevant borderline.

- Borderline students cannot be considered for promotion if they have failed any module and passed on second attempt

Prizes: there are two prizes to be awarded to outstanding students, as follows:

- **Prize for Excellence in Research and Science Communication** – citation: "Student with outstanding performance in the Research Project component of the Molecular Science and Engineering MRes"
- **Prize for Excellence** – citation: "Student with outstanding performance in the Molecular Science and Engineering MRes"

Indicative 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
CENG96014	Underpinning Molecular Science	Core	1	14	See module leader			0%	100%	0%	6	5
CENG96013	Fundamentals of Molecular Engineering	Core	1	16	See module leader			40%	50%	10%	6	5
CENG97060	Design of Molecular Systems	Core	1	15	110	0	125	0%	100%	0%	7	5
CENG97063	Manufacturing Processes	Core	1	23	See module leader			0%	100%	0%	7	5
CENG97062	Multiscale Modelling – Understanding, Visualising, and Predicting	Core	1	36	See module leader			60%	40%	0%	7	5
CENG97061	Measuring – Analysis and Characterisation	Core	1	15	110	0	125	0%	80%	20%	7	5
CENG97064	Making – Synthesis of Polymeric Systems	Core	1	15	See module leader			80%	20%	0%	7	5
CENG97065	Research Project	Core	1	20	955	400	1375	0%	65%	35%	7	55

Supporting Information
The Programme Handbook is available at: here
The Module Handbook is available at: link
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
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/charter-and-statutes/
Imperial College London is regulated by the Office for Students (OfS) https://www.officeforstudents.org.uk/

Modifications			
Change to the learning & teaching and independent study hours for the module "Underpinning Molecular Science"	Programmes Committee	13 December 2016	PC.2016.49
Change to the learning & teaching and independent study hours for the module "Fundamentals of Molecular Engineering"	Programmes Committee	13 December 2016	PC.2016.49
Change to the learning & teaching and independent study hours for the module "Designing Molecular Systems for Sustainability"	Programmes Committee	13 December 2016	PC.2016.49
Change to the ECTs value from 6 to 5 for the module "Designing Molecular Systems for Sustainability"	Programmes Committee	13 December 2016	PC.2016.49
Change to the learning & teaching and independent study hours for the module "Manufacturing Processes"	Programmes Committee	13 December 2016	PC.2016.49
Change to the ECTs value from 6 to 5 for the module "Manufacturing Processes"	Programmes Committee	13 December 2016	PC.2016.49

Change to the learning & teaching and independent study hours for the module "Multiscale Modelling – Understanding, Visualising, and Predicting"	Programmes Committee	13 December 2016	PC.2016.49
Change to the ECTs value from 6 to 5 for the module "Multiscale Modelling – Understanding, Visualising, and Predicting"	Programmes Committee	13 December 2016	PC.2016.49
Change to the learning & teaching and independent study hours for the module "Measuring – Analysis and Characterisation"	Programmes Committee	13 December 2016	PC.2016.49
Change to the ECTs value from 6 to 5 for the module "Measuring – Analysis and Characterisation"	Programmes Committee	13 December 2016	PC.2016.49
Change to the learning & teaching and independent study hours for the module "Making – Synthesis for Device Manufacture"	Programmes Committee	13 December 2016	PC.2016.49
Change to the ECTs value from 6 to 5 for the module "Making – Synthesis for Device Manufacture"	Programmes Committee	13 December 2016	PC.2016.49
Change to the independent study hours for the module "Research Project"	Programmes Committee	13 December 2016	PC.2016.49
Change to the ECTs value from 50 to 55 for the module "Research Project"	Programmes Committee	13 December 2016	PC.2016.49