Programme Specification for the MRes in Nanomaterials

PLEASE NOTE. This specification provides a **concise** summary of the main features of the programme and the learning outcomes that a typical student might reasonably be expected to achieve and demonstrate if he/she takes full advantage of the learning opportunities that are provided. This specification provides a source of information for students and prospective students seeking an understanding of the nature of the programme and may be used by the College for review purposes and sent to external examiners. More detailed information on the learning outcomes, content and teaching, learning and assessment methods of each module can be found in the course handbook or online at [http://www3.imperial.ac.uk/chemistry/admissions/postgraduatecourses/mres_nanomaterials](http://www3.imperial.ac.uk/chemistry/admissions/postgraduatecourses/mres_nanomaterials). The accuracy of the information contained in this document is reviewed by the College and may be checked by the Quality Assurance Agency.

1. **Awarding Institution:** Imperial College London
2. **Teaching Institution:** Imperial College London
3. **External Accreditation by Professional / Statutory Body:** Not applicable
4. **Name of Final Award** (BEng / BSc / MEng etc): MRes
5. **Programme Title** (e.g. Biochemistry with Management): Nanomaterials Science
6. **Name of Department / Division:** Department of Chemistry
7. **Name of Faculty:** Natural Science
8. **UCAS Code** (or other coding system if relevant): Not applicable
9. **Relevant QAA Subject Benchmarking Group(s) and/or other external/internal reference points**

Chemistry and Materials

10. **Level(s) of programme within the Framework for Higher Education Qualifications (FHEQ):**

<table>
<thead>
<tr>
<th>Level(s)</th>
<th>Programme</th>
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<tbody>
<tr>
<td>Bachelor’s (BSc, BEng, MBBS)</td>
<td>Level 6</td>
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<tr>
<td>Integrated Master’s (MSci, MEng)</td>
<td>Levels 6 and 7</td>
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<tr>
<td>Master’s (MSc, MRes)</td>
<td>Level 7</td>
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11. **Mode of Study:** full time
12. **Language of Study:** English

13. **Date of production / revision of this programme specification** (month/year): February 2017

14. **Educational aims/objectives of the programme**

The programme aims/objectives are to:

- Produce physical sciences postgraduates equipped to pursue careers in nanomaterials science, in industry, the public sector and non-governmental organisations;
- develop the ability to undertake research in multidisciplinary teams at this interface;

1. MRes in Nanomaterials
- develop a knowledge of a range of basic and advanced nanomaterials concepts;
- develop research and analytical skills related to nanomaterials research;
- develop oral and written scientific presentation skills;
- attract the most motivated physical sciences graduates, both from the UK and overseas;
- develop new areas of teaching in response to the advance of scholarship and the needs of vocational training.

15. Programme Learning Outcomes

1. Knowledge and Understanding

<table>
<thead>
<tr>
<th>1. core concepts in nanomaterials – semiconductor nanostructures, nanomaterials for solar energy conversion, optical and electrical properties, nanotubes, advanced materials characterisation and theory modelling and simulation.</th>
<th>Teaching/learning methods and strategies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acquisition of A1 to A5 is through a combination of lectures, seminars, coursework and research. Throughout the course, the students are encouraged to undertake independent reading both to supplement and consolidate what is being taught/learnt and to broaden their individual knowledge and understanding of the subject. Assessment of the knowledge base is through a combination of unseen written examinations, (A1-2), coursework exercises and assessed project work (A3-5).</td>
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<tr>
<td>2. specialised concepts in nanomaterials – molecular nanobiotechnology, colloidal semiconductors, patterning techniques, photonic and optoelectronic applications, quantum theory of nanoscale systems, modelling of charge transport and recombination, modelling of colloidal systems and wetting phenomena.</td>
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<tr>
<td>3. research techniques, including information retrieval, experimental design, modelling, materials characterisation techniques, and laboratory safety;</td>
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<td>4. detailed knowledge and understanding of the essential facts, concepts, principles and theories relevant to the student’s project;</td>
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<tr>
<td>5. management and communication skills, including problem definition, project design, decision processes, teamwork, written and oral reports, scientific publications.</td>
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</table>

2. Skills and other Attributes

2 MRes in Nanomaterials
### Intellectual Skills

1. analyse and solve problems in nano-materials science using an integrated multidisciplinary approach;
2. integrate and evaluate information;
3. formulate and test hypotheses using appropriate experimental design and analysis of data;
4. plan, conduct and write-up a programme of original research.

### Teaching/learning methods and strategies

Intellectual skills are developed through the teaching and learning methods outlined above and in section 11.

Experimental design skills are developed in lectures and subsequently in the individual research project.

Individual, formative and summative feedback is given to students by the project team. The feedback on the project synopsis / research plan submitted in November provides important summative feedback on student progress.

Assessment is through research project plan, unseen written examinations and the individual research project.

### Practical Skills

1. plan and execute safely a series of experiments;
2. use laboratory–based methods to generate data;
3. analyse experimental results and determine their strength and validity;
4. prepare technical reports;
5. give technical presentations;
6. use the scientific literature effectively;
7. use computational tools and packages.

### Teaching/learning methods and strategies

Practical skills are developed through the teaching and learning programme outlined above (and in section 11).

Practical experimental skills (C1 to C3) are developed through project work.

Skills C4 and C5 are taught and developed through feedback on reports written and presentations made as part of coursework assignments.

Skill C6 is developed through the project synopsis / research plan, presentation workshops and supervised research project.

Skill C7 is taught and developed through project work. Practical skills are assessed through the project synopsis / research plan and the research project dissertation and talk.
### Transferable Skills

<table>
<thead>
<tr>
<th>Number</th>
<th>Description</th>
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<tbody>
<tr>
<td>1.</td>
<td>communicate effectively through oral presentations, computer processing and presentations, written reports and scientific publications;</td>
</tr>
<tr>
<td>2.</td>
<td>apply statistical and modelling skills;</td>
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<tr>
<td>3.</td>
<td>management skills: decision processes, objective criteria, problem definition, project design and evaluation, risk management, teamwork and coordination;</td>
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<tr>
<td>4.</td>
<td>integrate and evaluate information from a variety of sources;</td>
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<td>5.</td>
<td>transfer techniques and solutions from one discipline to another;</td>
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<tr>
<td>6.</td>
<td>use Information and Communications Technology;</td>
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<tr>
<td>7.</td>
<td>manage resources and time;</td>
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<tr>
<td>8.</td>
<td>learn independently with open-mindedness and critical enquiry;</td>
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<tr>
<td>9.</td>
<td>learn effectively for the purpose of continuing professional development.</td>
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### Teaching/learning methods and strategies

Transferable skills are developed through the teaching and learning programme outlined above and in section 11.

- **Skill D1** is taught through coursework and developed through feedback on assessed reports and oral presentations.
- **Skill D2** is taught through lectures and practical work and developed, as appropriate, during individual research project.
- **Skill D3** is developed in the research team meetings (eg bi-weekly) and by putting together a project synopsis / research plan.
- **Skill D4** is developed through feedback on a research project plan.
- **Skill D5** is a core activity of the research projects and is additionally taught in lectures.
- **Skill D6** is taught in lectures developed through project work and individual learning.
- **Skill D7** is developed throughout the course within a framework of staged coursework deadlines.

Although not explicitly taught, skills D8 and D9 are encouraged and developed throughout the course, which is structured and delivered in such a way as to promote this. An example is the student participation in an international research conference during the course.

### 16. The following reference points were used in creating this programme specification

- Student Handbook for Course approved by Senate of Imperial College
- Programme description in the EPSRC grant proposal which funded the course until 2008/2009

### 17. Programme structure and features, curriculum units (modules), ECTS assignment and award requirements

The programme is only offered as a full-time, one-year course and leads to the MRes degree. Students begin their lecture programme with core courses mostly in the first term (October-December) and follow this up in second term (January-March) with advanced courses. The core courses are examined in January and the advanced courses are examined in April. For skills development, the students are required to make (assessed and unassessed) oral presentations on research in the scientific literature. In October students choose a 10 month (November-August) multidisciplinary research project. They present a project synopsis / research plan on the topic of their research in November and a final report and talk on the research in September. The overall pass mark is 50% and the research project and taught elements contribute 60% and 40% to the total mark, respectively; students are required
to pass both elements for a successful completion of the course. Students obtaining marks within 2.5% of a grade boundary may be called to viva by the external examiners at their discretion.

**Year One:**

**Term one:**

Students choose 3 possible research projects after discussion with academic staff in the first three weeks. They are allocated a project from this selection at the end of October. Under the supervision of their project team they start researching and writing their project synopsis / research plan, to be submitted in December. Students start their core courses, which cover the following topics, given in Lecture modules: (i) Renewable Energy; (ii) characterisation of nanomaterials; (iii) Plastic Electronics; (iv) Nanomaterials; (v) Membrane Biophysics. The students will have the opportunity to present scientific work from the literature at presentational workshops. They will also attend a lab course on nanomaterials characterisation.

**Term Two:**

At the beginning of the second term students are examined in the core lecture courses. Students will by this time already have spent time on their research projects. They will also be examined on the nanomaterials characterisation course. The students will attend 5 two hour lectures on, for example, the following topics and assessed by a group presentation:

- Cellular Nanobiotechnology A Cass
- Organic Electronic Materials S Haque
- Single Molecule Detection J Edel
- Perovskite Solar Celle P Barnes
- Computer-aided design of porous materials K Jelfs

**Term Three:**

Project assessment in August is based on a written dissertation and a scientific talk in early September. Students obtaining marks within 2.5% of a grade boundary may be called to viva by the external examiners at their discretion.

18. Support provided to students to assist learning (including collaborative students, where appropriate).

- **MRes booklet, which includes course descriptions.**
- Typically two supervisors per student.
- A large community of postgraduate research students and postdoctoral research workers working in nanomaterials sciences at Imperial College, the London Centre for Nanotechnology, the Thomas Young Centre, the Energy Futures Laboratory and the Institute for Cancer Research and external industrial partners.
- Library and other learning resources and facilities at South Kensington campus.
- Computing facilities in the Chemistry Departments.
- Extensive research facilities for nanomaterials research.
- A postgraduate staff - student committee, which meets three times per year.
• Visiting speaker ‘Foresight’ seminar series on topics in nanomaterials
• In addition to the postgraduate tutor the Course Director and/or coordinator assist students with personal problems and advises on pastoral and academic issues.
• Student email and open personal access to staff including the Course Director.
• Access to student counsellors on the South Kensington site.
• Access to Teaching and Learning Support, and Personal Development Services, which provide assistance and guidance, e.g. on careers.
• Employer needs and opinions feed into the programme through frequent guest lecturers from industry, joint projects with industry and collaboration between academic staff and industry in research and consultancy

19. Criteria for admission:

The minimum qualification for admission is normally an upper Second Class Honours degree in a Physical Sciences-based subject from an UK academic institution or an equivalent overseas qualification. All UK applicants (and where possible overseas applicants) are invited to Imperial College for a site tour and interview, offers made to students are initiated by the Course Directors.

20. Processes used to select students:

- Imperial College Registry checks eligibility of applicants
- Course Directors review and evaluate applications from an academic point of view
- Formally eligible with a sufficiently strong track record will normally be invited to an interview with the course directors (in person, by ‘phone or videoconference)

21. Methods for evaluating and improving the quality and standards of teaching and learning

a) Methods for review and evaluation of teaching, learning, assessment, the curriculum and outcome standards:

The external examiner system and Boards of Examiners are central to the process by which the College monitors the reliability and validity of its assessment procedures and academic standards. Boards of Examiners comment on the assessment procedures within the College and may suggest improvements for action by relevant departmental teaching Committees.

The Faculty Studies Committees and the Graduate Schools’ Postgraduate Quality Committees review and consider the reports of external examiners and accrediting bodies and conduct periodic (normally quinquennial) and internal reviews of teaching provision. Regular reviews ensure that there is opportunity to highlight examples of good practice and ensure that recommendations for improvement can be made.

At programme level, the Head of Department/Division has overall responsibility for academic standards and the quality of the educational experience delivered within the department or division.

Most of the College’s undergraduate programmes are accredited by professional engineering and science bodies or by the General Medical Council. Accreditation provides the College with additional assurance that its programmes are of an appropriate standard and relevant to the requirement of industry and the professions. Some postgraduate taught courses are also accredited.

Practice specific to the MRes Nanomaterials course:

- Annual course review prepared by the Course Director and considered by the Board of Examiners.
- Postgraduate Staff – Student Committee, held each term, with report to Departmental Teaching Committee.
- External Examiner reports.
- End-of-course anonymous questionnaire for student feedback on MRes course
• Periodic review of departmental teaching by an external panel (approximately 6 year interval).

b) Committees with responsibility for monitoring and evaluating quality and standards:

The Senate oversees the quality assurance and regulation of degrees offered by the College. It is charged with promoting the academic work of the College, both in teaching and research, and with regulating and supervising the education and discipline of the students of the College. It has responsibility for approval of changes to the Academic Regulations, major changes to degree programmes and approval of new programmes.

The Quality Assurance Advisory Committee (QAAC) is the main forum for discussion of QA policy and the regulation of degree programmes at College level. QAAC develops and advises the Senate on the implementation of codes of practice and procedures relating to quality assurance and audit of quality and arrangements necessary to ensure compliance with national and international standards. QAAC also considers amendments to the Academic Regulations before making recommendations for change to the Senate. It also maintains an overview of the statistics on completion rates, withdrawals, examination irregularities (including cases of plagiarism), student appeals and disciplinaries.

The Faculty Studies Committees and Graduate School Postgraduate Quality Committees are the major vehicle for the quality assurance of undergraduate/postgraduate courses respectively. Their remit includes: setting the standards and framework, and overseeing the processes of quality assurance, for the areas within their remit; monitoring the provision and quality of e-learning; undertaking reviews of new and existing courses; noting minor changes in existing programme curricula approved by Departments; approving new modules, changes in module titles, major changes in examination structure and programme specifications for existing programmes; and reviewing proposals for new programmes, and the discontinuation of existing programmes, and making recommendations to Senate as appropriate.

The Faculty Teaching Committees maintain and develop teaching strategies and promote inter-departmental and inter-faculty teaching activities to enhance the efficiency of teaching within Faculties. They also identify and disseminate examples of good practice in teaching.

Departmental Teaching Committees have responsibility for the approval of minor changes to course curricula and examination structures and approve arrangements for course work. They also consider the details of entrance requirements and determine departmental postgraduate student numbers. The Faculty Studies Committees and the Graduate School Postgraduate Quality Committees receive regular reports from the Departmental Teaching Committees.

Practice specific to the MRes Nanomaterials course:

- Postgraduate Staff – Student Committee (three meetings annually).
- Departmental Teaching Committee (Chemistry).
- Board of Examiners.
- Imperial College, Faculty of Science Quality and Academic Review Committee.
- Imperial College, Senate.

Practice specific to the MRes Nanomaterials course:

• Meetings with project supervisors.
• Meetings with Course Director.
• End-of-course anonymous questionnaire for student feedback on MRes course.
d) Mechanisms for gaining student feedback on the quality of teaching and their learning experience and how students are provided with feedback as to actions taken as a result of their comments:

- Postgraduate Staff – Student Committee.
- Meetings with project supervisors.
- Meetings with Course Director.
- End-of-course anonymous questionnaire for student feedback on MRes course

e) Mechanisms for monitoring the effectiveness of the personal tutoring system:

The course directors and administrator act as personal tutors.

f) Mechanisms for recognising and rewarding excellence in teaching and in pastoral care:

Staff are encouraged to reflect on their teaching, in order to introduce enhancements and develop innovative teaching methods. Each year College awards are presented to academic staff for outstanding contributions to teaching, pastoral care or research supervision. A special award for Teaching Innovation, available each year, is presented to a member of staff who has demonstrated an original and innovative approach to teaching. Nominations for these awards come from across the College and students are invited both to nominate staff and to sit on the deciding panels.

g) Staff development priorities for this programme include:

- Development of multidisciplinary research programmes in nanomaterials.
- Staff appraisal scheme and institutional staff development courses.

22. Regulation of Assessment

a) Assessment Rules and Degree Classification:

For undergraduate programmes classification of degrees will be according to the following range of marks:

- First class 70 - 100%
- Second class (upper division) 60 - 69.9%
- Second class (lower division) 50 - 59.9%
- Third class 40 - 49.9%

For postgraduate taught programmes: The Pass Mark for postgraduate taught courses is 50%. In order to be awarded a result of merit, a candidate must obtain an aggregate mark of 60% or greater; a result of distinction requires an aggregate mark of 70% or greater.

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.

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.

b) Marking Schemes for undergraduate and postgraduate taught programmes:

The Pass Mark for all undergraduate modules is 40%. From October 2008 entry all undergraduates are required to pass all their course units to progress to the next year.
The Pass Mark for all postgraduate taught course modules is 50%. Students must pass all elements in order to be awarded a degree.

c) Processes for dealing with mitigating circumstances:

For undergraduate programmes: Candidates with mitigating circumstances are not subject to the borderline restrictions but should be considered individually. However, as a general principle, candidates whose marks are more than 5% below the borderline should not normally be raised to the next higher classification. Where the Board of Examiners determines that a higher classification should be awarded extra marks should be applied to bring the final marks into the higher range.

For postgraduate taught programmes: A candidate for a Master’s degree who is prevented owing to illness or the death of a near relative or other cause judged sufficient by the Graduate Schools from completing at the normal time the examination or Part of the examination for which he/she has entered may, at the discretion of the Examiners,

(a) Enter the examination in those elements in which he/she was not able to be examined on the next occasion when the examination is held in order to complete the examination,

or

(b) be set a special examination in those elements of the examination missed as soon as possible and/or be permitted to submit any work prescribed (e.g. report) at a date specified by the Board of Examiners concerned. The special examination shall be in the same format as specified in the course regulations for the element(s) missed.

Applications, which must be accompanied by a medical certificate or other statement of the grounds on which the application is made, shall be submitted to the Academic Registrar who will submit them to the Board of Examiners.

d) Processes for determining degree classification for borderline candidates:

For undergraduate programmes: 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 could include an oral examination or practical test or other mechanism appropriate to the discipline. Candidates whose marks are below the 2.5% borderline may be considered for a higher honours classification where certain provisions apply. Where the Board of Examiners determines that a candidate should be awarded a higher honours classification extra marks should be applied to bring their final marks into the higher range. Detailed records of all decisions should be recorded in the minutes of the meeting of the Board.

For postgraduate taught programmes: Candidates should only be considered for promotion to pass, merit or distinction if their aggregate mark is within 2.5% of the relevant borderline. Nevertheless, candidates whom the Board deems to have exceptional circumstances may be considered for promotion even if their aggregate mark is more than 2.5% from the borderline. In such cases the necessary extra marks should be credited to bring the candidate’s aggregate mark into the higher range.

e) Role of external examiners:

The primary duty of external examiners is to ensure that the degrees awarded by the College are consistent with that of the national university system. External examiners are also responsible for approval of draft question papers, assessment of examination scripts, projects and coursework (where appropriate) and in some cases will attend viva voce and clinical examinations. Although external examiners do not have power of veto their views carry considerable weight and will be treated accordingly. External examiners are required to attend each meeting of the Board of Examiners where recommendations on the results of individual examinations are considered. External examiners are required to write an annual report to the Rector of Imperial College which may include observations on teaching, course structure and course content as well as the examination process as a whole. The
College provides feedback to external examiners in response to recommendations made within their reports.

23. Indicators of Quality and Standards

The external examiners write a report which is passed to the Executive Committee of the Graduate School of Engineering and Physical Sciences (GSEPS), the Head of the Chemistry Department, and the MRes course director/coordinator for comments and action if required.

Please note. This specification provides a concise summary of the main features of the programme and learning outcomes that a typical student might reasonably be expected to achieve and demonstrate if she/he takes full advantage of the learning opportunities that are provided. The accuracy of the information contained in this document is reviewed by the College and may be checked by the Quality Assurance Agency for Higher Education (QAA) and by the Engineering and Physical Sciences Research Council (EPSRC).

The course was evaluated as ‘Good’ (the highest grade) by the Graduate School in 2014.

24. Key sources of information about the programme can be found in

- Imperial College London (www.imperial.ac.uk)
- Department of Chemistry, http://www3.imperial.ac.uk/chemistry/