Programme Specification for the MSc in Advanced Chemical Engineering with Process Systems Engineering

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 on-line at http://www3.imperial.ac.uk/chemicalengineering/courses/postgraduate/msc. 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/None
4. Name of Final Award (BEng / BSc / MEng etc): MSc
5. Programme Title (e.g. Biochemistry with Management): Advanced Chemical Engineering with Process Systems Engineering
6. Name of Department / Division: Chemical Engineering
7. Name of Faculty: Engineering
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: Engineering
10. Level(s) of programme within the Framework for Higher Education Qualifications (FHEQ):

| Master's (MSc, MRes) | Level 7 |

11. Mode of Study: Full Time
12. Language of Study: English
13. Date of production / revision of this programme specification (month/year): November 2015

14. Educational aims/objectives of the programme:

The programme aims/objectives are to:

- produce graduates equipped to pursue careers in Process System Engineering in industry, the public sector and non-governmental organizations;
- provide the basis for the recognition and understanding of the major features of Process System Engineering and Chemical Engineering;

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• develop an understanding of how this knowledge may be applied in practice in an economic and environmentally sustainable fashion;
• foster the acquisition and implementation of broad research and analytical skills related to Process System Engineering and Chemical Engineering;
• attract highly motivated students, both from within the UK and from overseas;
• develop new areas of teaching in response to the advance of scholarship and the needs of vocational training;
• offer a means to provide an introduction to the subject for students from other disciplines

15. Programme Learning Outcomes:

1. Knowledge and Understanding

Knowledge and Understanding of:

1. a selection of the major topics in the subject, their recognition and underlying fundamental principles
2. research techniques which might include information retrieval, experimental design and statistics, modelling and safety;
3. the essential facts, concepts, principles and theories relevant to the student’s area of research;
4. management and communication skills, including problem definition, project design, decision processes, teamwork, written and oral reports, scientific publications.

Acquisition of the points listed above is through a combination of lectures, seminars, laboratory work, computer-based work, coursework and independent work on a research project. Point 4 is also supported by attendance at a number of skills workshops, both compulsory and optional.

Throughout the course, 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 and assessed coursework, as well as an individual literature review, presentation and thesis focusing on the research project.

2. Skills and other Attributes

Intellectual Skills:

Upon completion of the programme, students should be able to:
1. analyse and solve problems using a multidisciplinary approach, applying professional judgements to balance costs, benefits, safety and social and environmental impact;
2. integrate and critically evaluate information;
3. formulate and apply appropriate solutions;
4. plan, conduct and write-up a programme of original research.

Intellectual skills are developed through the teaching and learning methods outlined above, and in the Knowledge and Understanding section. Assessment is through coursework, unseen written examinations, project reports and a presentation.

Practical Skills:

Upon completion of the programme, students should be able to:
1. plan and execute safely a series of experiments or computations;
2. use laboratory methods or computer-based tools to generate data;

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3. analyse results, determine their strength and validity, and make recommendations;
4. prepare technical reports;
5. give technical presentations;
6. use scientific literature effectively;

Practical skills are developed through the teaching and learning programme outlined above (and in section 17).

Practical experimental or computational skills (points 1 to 3) are developed through project work and coursework, and through interaction with other research students and the research supervisor(s). Skills 4 and 5 are taught and developed through workshops, feedback on written reports and presentations.

Skill 6 is developed through lectures, coursework reports and the individual supervised research project.

Practical skills are assessed where appropriate through the project reports and presentation.

**Transferable Skills:**

Upon completion of the programme, students should be able to:
1. communicate effectively through oral presentations, computer processing and presentations, and written reports;
2. apply knowledge and modelling skills;
3. apply acquired management skills: decision processes, objective criteria, problem definition, project design and evaluation needs;
4. integrate and evaluate information from a variety of sources;
5. transfer techniques and solutions from one discipline to another;
6. use Information and Communications Technology;
7. manage resources and time;
8. learn independently with open-mindedness and critical enquiry;
9. learn effectively for the purpose of continuing professional development.

Transferable skills are developed through the teaching and learning programme outlined above and in section 17.

Skill 1 is taught through workshops and feedback on reports and oral presentations.
Skill 2 is taught through lectures and practical work and developed, as appropriate, during individual research projects.
Skills 3 to 5 are developed through project work.
Skill 6 is developed through workshops, computer-based exercises, projects and other coursework activities and individual learning.
Skill 7 is developed throughout the course within a framework of staged coursework deadlines and the split examination system.
Although not explicitly taught, skills 8 and 9 are encouraged and developed throughout the course, which is structured and delivered in such a way as to promote this.

Skill 1 is assessed through written examinations, coursework and the oral presentation.
Skill 2 is assessed through coursework, written examinations and project work.
Skills 3 to 5 are assessed in project work.
The other skills are not assessed formally.

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

- Subject benchmarking information for Chemical Engineering.
- Student Handbook for Course approved by Senate of Imperial College.
17. Programme structure and features, curriculum units (modules), ECTS assignment and award requirements

The programme is offered as a full-time one year course and leads to the MSc degree. Students take a mixture of core and optional courses in the first (October-December) and second term (January-March). Students are required to select 8 modules for examination (see below). An individual research project is carried out continuously from November. From June onwards, all student time is devoted to the research project. The projects are normally conducted at Imperial College, but can involve an industrial collaboration and/or an approved collaborative institution. The overall pass mark is 50% with a requirement to separately achieve 50% in the modules (written examinations and associated coursework) and 50% in the research project.

Contributions to the research project mark are 10% from the presentation, 10% from the literature review and 80% from the thesis. A series of workshops to develop professional skills must also be attended by students.


6 ECTS credits are assigned to each taught module. A total of 48 ECTS credits are assigned to the taught element of the course and 42 ECTS credits to the research element. The course comprises of 90 ECTS credits in total.

Term one:
All students attend an induction week, which includes an introduction to the Department, Safety sessions and a two-day professional skills workshop facilitated by external consultants. In this period the students begin to consider their lecture modules and project. In addition, they have the opportunity to meet with the Postgraduate Tutor who acts as their Personal Tutor during the initial phase of the course. The students are required to select preferred projects by the end of the first week. Research projects are then confirmed within four weeks of the start of term and supervisors and projects are allocated in this period. Students are required to formally notify the Postgraduate Office of their module options for examination by February. Students are encouraged to begin to put in place those arrangements that are deemed appropriate for their research projects during this period and especially to focus on developing an understanding of the research problem. Those students with perceived English language deficiencies are encouraged to at this stage to seek remedial support from the English Language Support Unit.

Term Two:
Students continue to follow selected lecture courses, and dedicate the equivalent of approximately one day a week to their independent research project. At this stage it is hoped that the students have a full understanding of the nature and needs associated with the project. The students submit a Literature Review (maximum 6,000 words) in mid-February. The Literature Review is assessed in the first instance by the supervisor.

Term Three:
All examinations are conducted during this term. Students can dedicate themselves full-time to their research project after the final examinations, and give a poster presentation in mid-September. Overall research assessment is based primarily upon a written thesis which students submit by the 3rd week of September. The thesis is assessed by the supervisor and an internal
assessor. Further scrutiny is provided the External Examiners and the Board of Examiners (comprising a Chair and a number of appointed Internal Examiners).

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

- One week induction programme for orientation, introduction to library and information technology, and the Department. This also includes a session comprising talks from the Head of Department, Director of Postgraduate Study, MSc Co-ordinator and Postgraduate Tutor outlining pastoral support, facilities available to students and the structure of the course.
- MSc Student Handbook, which includes descriptions of each module, Departmental and College-wide facilities, information about pastoral care and English language support.
- A large community of postgraduate research students and postdoctoral research workers who work in the general area of chemical engineering. The research programmes in the Department provide general as well as specific support.
- Library and other learning resources and facilities.
- Dedicated computing facilities.
- 2 MSc students in the Staff/Student Committee, which meets twice per year.
- Many visiting speakers, numerous seminar series in all facets of chemical engineering.
- Student email and open personal access to tutorial staff including the Course Co-ordinator, Director of Postgraduate Studies, Postgraduate Tutor and Course lecturers.
- Periodic (bi-monthly) meetings with the MSc Course Co-ordinator
- Individual feedback on progress after Literature Review and examinations
- Access to student counsellors on the South Kensington site.
- Access to Teaching and Learning Support Services, which provide assistance and guidance, e.g. on careers.

19. Criteria for admission:

The minimum qualification for admission is normally an Upper Second Class Honours degree in chemical engineering from a UK academic institution or an equivalent overseas qualification, or an Upper Second Class Honours degree in another engineering discipline or a science-based subject from a UK academic institution or equivalent overseas qualification with relevant experience. All applicants must meet the College’s English Requirement for Postgraduate Applicants.

20. Processes used to select students:

All application document including academic transcripts will be assessed by the College Registry upon submission. Applications that have met the College minimum requirement for PG admissions will be considered by the Postgraduate Admissions Tutor. Decision on acceptance is mainly based on the academic performance in previous degrees taking account of academic references and relevant work/research experience. All UK applicants (and where possible overseas applicants) are encouraged to visit the College Postgraduate Open Day and are welcome to visit the Department throughout the year by prior arrangement.

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.

Students will also take part in the ‘PG-SOLE’ (Post-graduate On-Line Evaluation) for all taught courses.

At a Departmental level the following mechanisms are also used:

- Module reviews, based on feedback questionnaires.
- Biennial review of the course by an Imperial College academic staff member from outside the department with a report and grading to the Graduate Studies Committee.
- Staff – Student Committee, held each term, with report to Departmental Teaching Committee.
- Annual staff appraisals.
- Peer teaching observations.
- External Examiner reports.
- Periodic review of the overall course through ad-hoc Working Parties, reporting to the Head of Department.

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.

At a Departmental level the following Committees are involved:

- Staff – Student Committee.
- Undergraduate Course Committee (several MSc modules are also offered as Undergraduate options)
- Board of Examiners – meets in October to consider awards.
- Departmental Tutors’ Committee.
- Departmental Teaching Committee.

c) Mechanisms for providing prompt feedback to students on their performance in coursework and examinations and processes for monitoring that these named processes are effective:

Coursework assignments during the year are normally marked within two weeks of submission. Early feedback to students on research performance is given following assessment of the Literature Review (submitted mid-February) and Research Presentations (mid-September).

A preliminary Examiners’ Meeting is held in July to confer research marks to date, as well as provisional examination marks (which are not formally ratified until October). Some informal feedback on progress can then be given to students, including an indication of overall exam performance and research marks to date.

The exit questionnaire that all students are asked to complete upon submission of their thesis is used to monitor the effectiveness of our feedback procedures.

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:

Two MSc students sit on the Staff – Student committee, which allows the students to provide feedback directly to the Department, and receive updates on actions taken as a result of their feedback. We also invite the entire cohort to periodic meetings with the course Co-ordinator to discuss important issues and to allow the students to feedback on issues affecting them.

There is also the exit questionnaire, which has often been used to make minor modifications to the way the course, or modules, are delivered.

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

The research project supervisor acts as a de facto personal tutor. Any problems that are not solved this way are referred to the Course Co-ordinator and Postgraduate Tutor, and if necessary to the Director of Postgraduate Studies. The effectiveness of this mechanism is periodically reviewed.

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:

- active research programme in Chemical Engineering;
- staff appraisal scheme and institutional staff development courses;
• College Teaching Development Grant Scheme to fund the development of new teaching and appraisal methods;
• updating professional and IT/computing developments.

22. Regulation of Assessment
Assessment Rules and Degree Classification:

For postgraduate taught programmes: The Pass Mark the course is 50% in both the Exam and Research components. In order to be awarded a result of merit, a candidate must obtain an aggregate mark of 60% or greater in both components; a result of distinction requires an aggregate mark of 70% or greater in both components.

Where appropriate, a Board of Examiners may award a result of pass where a candidate has achieved an aggregate mark of 50% or greater in the Exam component, but marginally failed one individual examination.

a) Processes for dealing with mitigating circumstances:

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.

b) Processes for determining degree classification for borderline candidates:

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.

c) 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:**

- Favourable comments by External Examiners.
- Research training in Chemical Engineering and related areas.
- The last Graduate School Quality Assessment exercise (2014) rated the course as ‘good’ (the best possible).
- Exit surveys from students indicate excellent overall satisfaction with the course (>90% in Spring 2013)

24. **Key sources of information about the programme can be found in** (links to course handbook, prospectus, departmental website, syllabus etc):

The course handbook is available to students in hard copy, or electronically via Blackboard. Information on our Departmental site can be found here:
http://www3.imperial.ac.uk/chemicalengineering/courses/postgraduate/msc

And information in the College prospectus is here:
http://www3.imperial.ac.uk/pgprospectus/facultiesanddepartments/chemicalengineering/postgraduate
courses/ace