University of Cambridge: Programme Specifications

Every effort has been made to ensure the accuracy of the information in this programme specification. Programme specifications are produced and then reviewed annually by the relevant teaching faculty or department and revised where necessary. However, we reserve the right to withdraw, update or amend this programme specification at any time without notice.

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www.admin.cam.ac.uk/univ/camdata/archive.html

MASTER OF PHILOSOPHY IN ADVANCED CHEMICAL ENGINERING

1	**Awarding body**	University of Cambridge
2	**Teaching institution**	Department of Chemical Engineering and Biotechnology
3	**Accreditation details**	None
4	**Name of final award**	Master of Philosophy
5	**Programme title**	Advanced Chemical Engineering
6	**JACS code(s)**	H810
7	**Relevant QAA benchmark statement(s)**	Engineering
8	**Qualifications framework level**	7 (Masters)
9	**Date specification produced/ last revised**	June 2013
10	**Date specification last reviewed**	June 2013

Educational Aims of the Programme

The objectives of this Programme are to:

1) provide students with advanced technical skills in chemical engineering;
2) enable students to solve problems within a technical consulting environment;
3) provide students with business skills and a knowledge of entrepreneurship; and
4) provide training in research.

The deployment of technology by business, industry and government is increasingly bound up with complex economic, socio-political, regulatory, administrative and environmental issues. There is therefore a need to provide engineers and scientists with the knowledge and skills required to provide competent leadership in the constructive development and deployment of technology. There are few UK chemical engineering programmes that combine mainstream engineering courses with economic, policy and management courses, as this Programme does.

Programme Outcomes

Successful students should gain:

a) an advanced knowledge of fundamental areas of chemical engineering, such as numerical methods and molecular aspects;
b) an understanding of how discoveries and other ideas can be exploited effectively, including new company spin-outs, reorganisation of existing company structures,

technology licensing, *etc.*, by undertaking a series of business-based modules to include topics such as financing, marketing and sustainability;

c) the capacity to work in a team, under time constraints, to produce workable solutions to problems presented by a company during the Management of Technology and Innovation consultancy project. Key skills learnt will be time management, interaction with company personnel, obtaining technical and financial information, defining optimal outcomes for the company, and presentation and communication of results; and
d) the ability to define, organise and undertake a research project within a specified period of time and to report it in writing and by seminar in an acceptable manner – this project might involve basic chemical engineering research or might be business-based, and may involve industrial collaboration. This will introduce the candidate to the practical problems of undertaking research.

Other specific outcomes are listed below in sections on knowledge, intellectual skills and transferable skills.

Knowledge

By the end of the course, students should have:

1) a thorough knowledge in areas of key importance to chemical engineering (*e.g.* the solution of problems using the latest numerical techniques, and the developing field of micro- and nano-scale structures);
2) knowledge of key concepts in business administration (*e.g.* finance, economics and how to build a company); this will enable students to understand how discoveries and other ideas can be exploited effectively; and
3) an understanding of how to define and conduct a research project.

Intellectual Skills

By the end of the course, students should be able to:

1) translate fundamental discoveries in life sciences, materials and other high technology areas to commercial exploitation, and adapt readily to the challenges presented in a diverse range of industrial sectors that can benefit from process engineering approaches;
2) take a holistic approach in solving problems and designing systems by applying professional engineering judgement, particularly where there is technical uncertainty;
3) define, organise and execute either experimental or paper-based research and, in particular, understand the trade-off between obtainable results and constraints of time or finance;
4) undertake technical consultancy in unfamiliar companies or unfamiliar situations by applying problem-solving skills, particularly with regard to problem definition, team-working, project organisation and delivery of project objectives within the constraints imposed by the time and available information;
5) deal with complex issues both systematically and creatively, make informed judgements in the absence of complete data and in unpredictable situations, and act autonomously in planning and implementing solutions at a professional level;
6) understand how to transfer and exploit technology, and the best means of doing this, and have the confidence to express their entrepreneurial flair fully should they wish to consider the formation of new companies in their future careers; and
7) appreciate the wider business and strategic environment within which technical decisions are made.

Transferable Skills

By the end of the course, students should be able to:

1) prepare formal reports in a range of styles (*e.g.* executive summary, consultant's report, oral presentation and dissertation);
2) communicate ideas, reason critically and demonstrate and exercise independence of mind and thought;
3) manage time and work to deadlines, work effectively both independently and in groups, and assess the relevance and importance of the ideas of others; and
4) find information and learn effectively for the purpose of continuing professional development and in a wider context, throughout their career.

Teaching and Learning Methods

Students will participate in lectures, small group teaching (supervisions), tutor-led seminars and demonstrations, consultancy projects, case studies and research projects.

Assessment Methods

The chemical engineering aspects are assessed by both "unseen" examinations and by continuous assessment of written assignments. The business-based aspects are assessed as prescribed by the providers in the Judge Business School (JBS) and/or the Cambridge University Engineering Department (CUED); depending on the module, this could involve examination, continuous assessment of assignments, some assessment of class participation, *etc.,* or combinations of these. Other external modules are assessed according to the regulations of the institute or department concerned. The Management of Technology and Innovation consultancy project is assessed by oral presentation and written report. The research project is examined by appraisal of a dissertation and seminar. The aims of the assessment are to measure assimilation of theory and the ability to apply it.

Programme Structure

The Programme will occupy one year, with all examination commitments to be finished by 31st August in each year. Students will arrive in Cambridge in late September and spend the Michaelmas and Lent Terms undertaking at least ten 16-hour lecture modules and a consultancy project. From the end of Lent Term to the end of August, they will undertake a research project leading to a dissertation and seminar. The research project may involve industrial collaboration.

a) Michaelmas Term

The course starts in early October. During the Term, students take six taught modules. The following three modules are compulsory:

- Numerical Methods in Chemical Engineering
- Molecular Aspects of Chemical Engineering
- Management of Technology and Innovation

In addition, students take one core chemical engineering M.Eng. module from a list supplied, and two elective modules. Some typical core and elective modules are shown in Table 1. The listed modules contain at least 16 hours of lectures during the Term and students are expected to spend at least 4 evenings per week on coursework and private study. The courses are assessed by both unseen written examination and by submission of written coursework. Students will be able to adopt any suitable combination of the courses

except where this leads to a clash in examination times or in the lecture timetable. Courses offered may change from year to year, and so the list in Table 1 is not definitive.

Table 1. Typical core and elective modules for the Michaelmas and Lent Terms

Core Chemical Engineering Modules	**Elective Modules***
Advanced Transport Processes	Contaminated Land & Waste Containment
Biopharmaceuticals	Electricity and Environment
Biosensors	International Business Economics
Catalysis	Management of Technology
Colloid Science	Materials and Processes for Microsystems (MEMS)
Electrochemical Engineering	Nanotechnology
Fluid Mechanics & the Environment	Nuclear Materials
Healthcare Biotechnology	Nuclear Power Engineering
Modern Metrology	Strategic Management
Particle Technology	Sustainable Energy
Rheology & Processing	Sustainable Water Engineering
*** Run by the Cambridge University Engineering Department (CUED), the Judge Business School (JBS), and the Department of Materials Science and Metallurgy.*	

b) Lent Term

In addition to completing the compulsory Management of Technology and Innovation module, students take four modules comprising one core chemical engineering M.Eng. module and three elective modules (one of which could be another chemical engineering core module). Typical core and elective modules are shown in Table 1.

c) End of Lent Term to end of August

During this period, students undertake a research project leading to the production of a dissertation and seminar. The project could either be based on an engineering or business theme, and might include topics supervised outside the Department of Chemical Engineering and Biotechnology (*e.g.* at JBS or CUED), depending on the interest of academic staff at such departments. The project may involve industrial collaboration. The dissertation will not exceed 10,000 words in length. These dissertations could provide useful benefits for departments in, for example, defining new opportunities for research. Examinations in elective and core chemical engineering modules are also held in late April/early May and in late May/early June, respectively.

Admission Requirements

Admissions will be handled by the Board of Graduate Studies. Acceptance onto the course will be overseen by the Graduate Admissions Panel, drawn from members of staff of the Department of Chemical Engineering and Biotechnology. Admission will require an honours degree in Chemical Engineering or a closely-related engineering discipline. Because of the rigour of the technical parts of the course, applicants should preferably possess a 1st class degree from a reputable institution. A high 2.i or equivalent might be

acceptable in certain circumstances. In any case, applicants must demonstrate a high level of commitment and industry, irrespective of formal academic qualification.

Overall Assessment and Requirements for the Award of the Degree

The assessment of individual modules will be as specified by the module leaders. Assessment methods will be the same for all candidates in a module, and will generally be a combination of some or all of the following:

- Class participation
- Coursework – individual or group
- Examination
- Presentations – individual or group

There will be an External Examiner appointed for the Programme. The report of the External Examiner will be considered by the Teaching Committee of the Department of Chemical Engineering and Biotechnology, which will discuss and agree any necessary actions resulting from the report.

The core modules in chemical engineering will require candidates to take at least two of the Chemical Engineering Tripos Part IIB examination papers (at the same time as the Part IIB class) during the examination period in late May/early June.

All research projects will be examined by appraisal of a dissertation and seminar. The dissertations may also be examined on their subject matter in private by *viva voce* examination.

To gain the M.Phil. degree, candidates will normally be expected to reach at least the pass mark in both components of the course, namely (i) taught work and (ii) research project. A candidate could be offered an oral examination, at the discretion of the Examiners, if he or she were to fail, or be marginal, in **one** of these components.

Details of the marking procedure are given in Appendix A.

Indicators of Quality

Management of the quality of the Programme will be the responsibility of the Programme Director and Manager, reporting to the Department's UTO Committee. Students will be encouraged to give immediate verbal feedback to staff teaching on the Programme and to the Programme Director and Manager. They will also be asked to complete a quantitative and qualitative feedback questionnaire for each course, which will ask questions on the following issues:

- Quality of teaching
- Quality of visual aids
- Relevance of subject matter
- Difficulty of subject matter
- Workload
- Facilities (study space, IT, library, *etc.*)
- Quality of administrative support

Results of the questionnaires will be distributed to the relevant teaching staff. A summary of the quantitative feedback results will be issued to, and discussed at, the the Department's UTO Committee. Any action points arising from such discussions will be noted in the minutes of the meeting and actions will be followed up at subsequent meetings.

The academic content of the Programme will be reviewed regularly by the Programme Director and Manager, in conjunction with student feedback comments and discussions with colleagues. There will be a major strategic review of the Programme every three years. Any significant changes identified as necessary for the ongoing development and success of the Programme will be considered by the Department's UTO Committee and by the Chemical Engineering and Biotechnology Syndicate.

Learning Support

The principal features will be:

- Department induction programme for orientation at the start of the course
- Small group teaching (*e.g.* 6-12 students in supervisions/tutorials)
- Staff-student liaison committee, for feedback and course management
- Full support from the Programme Director and Manager

Each student is a member of a College and will therefore have access to learning support from both College and University. The College Tutor for Graduates will also play a role in support and guidance. The Department's learning resources include computing suites, laboratories, a library housing technical books, journals and electronic resources. There are also many other libraries in Cambridge to which students will have access.

Employment

Preparation for employment is provided in the opportunities for acquisition of relevant skills outlined above.

General Information

More information can be found at
http://www.ceb.cam.ac.uk/pages/m.phil-in-advanced-chemical-engineering.html

Appendix A: Principles Guiding the Assessment of Students for the Degree of M.Phil. in Advanced Chemical Engineering

The policies specified below are subject to review by the Degree Committee of the Faculty of Engineering, consistent with the Committee's powers.

1. In order to obtain the degree, students registered for the M.Phil. in Advanced Chemical Engineering will normally be required to obtain:
   - an average of at least 60% for the ten taught modules (two compulsory chemical engineering modules, one compulsory Management of Technology and Innovation module, two core chemical engineering modules, and five elective modules) – a mark of less than 50% on any module will be counted as a failure (the Examiners may, at their discretion, offer a candidate an oral examination if he or she were unable to obtain at least 50% in **one** of the taught modules); and
   - a pass for the research project (60% or greater).

   Cases of marginal failure will be considered individually by the Examiners.

2. Both the taught component and the research component form an assessment that will be equally weighted in computing an overall mark for the M.Phil. degree.

3. All students taking the M.Phil. course in Advanced Chemical Engineering will be assessed in the same way. This will include common deadlines, word lengths for written work and assessment procedures. The only exception will arise when modules themselves are assessed in different ways.

4. The Examiners for the M.Phil. in Advanced Chemical Engineering will receive marks on modules from different Departments (*e.g.* Chemical Engineering and Biotechnology, Engineering, Judge Business School). They will consider the grading system and the thresholds for pass and fail used in those Departments and, if necessary, map the raw mark obtained onto a prescribed scale for the M.Phil. course in Advanced Chemical Engineering.

5. The research project is assessed by dissertation and oral presentation. The dissertation should contain no more than 10,000 words and 40 pages. The assessment may, at the discretion of the Examiners, include a *viva voce* examination of the thesis, where students will be questioned in private on the general field of knowledge within which it falls.

6. The classification of the degree will be either Pass or Fail. Students who achieve an exceptional performance (*i.e.* an average of at least 75% in both components, and provided they have not failed any individual module) will normally be awarded a distinction.

7. The Examiners for the M.Phil. in Advanced Chemical Engineering may use their discretion when there are exceptional circumstances, and will make recommendations to, or accept decisions from, the Degree Committee of the Faculty of Engineering accordingly.