

Programme Specification 2019-20

MASTER OF PHILOSOPHY IN ADVANCED CHEMICAL ENGINEERING

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	July 2019

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 environment;
- 3) provide students with business and management skills; 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;
- 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 and/or individually, under time constraints, to produce workable solutions to technical problems. Key skills learnt will be time management, interaction with colleagues, obtaining technical and financial information, defining optimal outcomes and solutions, and presentation and communication of results;
- 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;
- 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;
- 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 projects 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;
- 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, technical 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,
- 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, technical 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 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 taught modules. 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 the compulsory module Numerical Methods in Chemical Engineering and four other modules from a list of core chemical engineering and elective subjects (at least one of the modules chosen must be a core chemical engineering one). Some typical core and elective modules are shown in Table 1, though these can change yearly. 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 unseen written examination or by submission of written coursework, or a combination thereof. 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

Core Modules	Elective Modules*
Bionanotechnology	Climate Change Mitigation
Biophysics	Contaminated Land & Waste Containment
Biosensors and Bioelectronics	Innovation and Strategic Management of IP
Computational Fluid Dynamics	Electricity and Environment
Fluid Mechanics and the Environment	International Business
Interface Engineering	Management of Technology
Optimisation	Nuclear Power Engineering
Pharmaceutical Engineering	Strategic Management
Rheology & Processing	

** Elective modules are led by staff within the Cambridge University Engineering Department (CUED) or the Judge Business School (JBS).*

b) Lent Term

During Lent Term students take a compulsory module on Data Analysis and four other modules from the list supplied (at least one of the modules chosen must be a core chemical engineering one).

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

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 high first class degree from a reputable institution. 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
- A research project submitted as a dissertation

There will be an External Examiner appointed for the programme. The report of the External Examiner will be considered by the University Teaching Officers' (UTO) 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 one 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 by *viva voce* examination.

To gain the M.Phil. degree, candidates will normally be expected to reach at least the pass mark (60%) 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. Students achieving an exceptional performance (normally averages >75% in both taught and research components) may be awarded a Distinction by the Examiners.

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, learning resources, 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 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 study space housing technical books, journals and electronic resources. There are also many other libraries in Cambridge to which students will have access.

Graduate employability and career destinations

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

The Careers Service maintains links with relevant employers and takes into account employer needs and opinions in the services which it provides for students. The Careers Service also allocates a Careers Adviser to each College, Faculty and Department to act as a point of contact.

Every effort has been made to ensure the accuracy of the information in this programme specification. At the time of publication, the programme specification has been approved by the relevant Faculty Board (or equivalent). Programme specifications are reviewed annually, however, during the course of the academical year, any approved changes to the programme will be communicated to enrolled students through email notification or publication in the Reporter. The relevant faculty or department will endeavour to update the programme specification accordingly, and prior to the start of the next academical year.

Further information about specifications and an archive of programme specifications for all awards of the University is available online at: <https://www.camdata.admin.cam.ac.uk/>