Programme Title: MSc in Computer Aided Engineering

Programme Specification

Awarding Body/Institution	Queen Mary, University of London
Teaching Institution	Queen Mary, University of London
Name of Final Award and Programme Title	MSc in Computer Aided Engineering
Name of Interim Award(s)	PG Certificate / PG Diploma
Duration of Study / Period of Registration	1 calendar year
QM Programme Code / UCAS Code(s)	H1S2
QAA Benchmark Group	Masters degrees
FHEQ Level of Award	Level 7
Programme Accredited by	Royal Aeronautical Society and Institution of Mechanical Engineers
Date Programme Specification Approved	11 Apr 2016
Responsible School / Institute	School of Engineering & Materials Science

Schools which will also be involved in teaching part of the programme
School of Mathematical Sciences

Institution(s) other than Queen Mary that will provide some teaching for the programme

Programme Outline

Modern industrial design is performed in the "virtual prototyping chain" where simulation and analysis of structures and fluids play a most important role. Advanced design is now increasingly performed using numerical optimisation loops where the engineer needs to set up, control and assess the results of complex chains of simulation tools. For these tasks, the engineer needs a very good understanding of the simulation tools to perform and assess the analysis, as well as basic programming skills to operate the chains. The MSc programme in Computer Aided Engineering aims to train students for this area.

The MSc Programme in Computer Aided Engineering is delivered with 120 credits of taught modules focusing at the core on Modelling Continuum Mechanics, Computational Structures, Computational Fluids and Numerical Optimisation. Students can choose from a number of options to focus on computational applications in either Aerospace, Mechanical, Energy or Biomedical Engineering. A 60 credit research project is to be undertaken using a wide range of industrial and in-house software packages in a topical specialisation area chosen by the student. The successful student will have good skills in the core simulation subjects, as well as advanced technical knowledge in the chosen area of specialisation.

The program is open to students with a Batchelor's degree in Applied Mathematics, Physics or Computer Science, as long as they have a background in solid or fluid mechanics.

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Aims of the Programme

The programme aims to prepare specialists with advanced skills in computational modelling and numerical optimisation and an in-depth understanding of engineering approaches to simulation and analysis of engineering problems. The students completing this programme will be able to provide advanced computational analysis and innovative design in Aeronautical, Mechanical, Energy and Biomedical Engineering.
The aims of the programme are:
- To provide students with a deep and systematic understanding of the background relevant to the advanced application of computational methods in engineering including the engineering modelling, the relevant aspects of linear algebra and numerical methods, as well as the pertinent aspects of software engineering,
- To enable students to analyse engineering problems in this area with critical awareness and apply these skills to problems arising from the relevant engineering disciplines covered by SEMS: aeronautical, mechanical, bio-medical and sustainable energy engineering,
- To enable students to gain systematic understanding of multi-disciplinary aspects in the application of CAE in the design and analysis of engineering systems,
- To achieve deeper understanding, demonstrate initiative and originality in problem solving by applying these concepts within a Master's project.

What Will You Be Expected to Achieve?

A successful student in this programme will

Academic Content:	
A 1	have obtained a systematic understanding of the principles of the finite element and finite volume methods and be able apply this to the analysis and simulation of relevant engineering problems, with critical awareness of specific issues in structural and fluid dynamics,
A 2	have obtained an understanding of the relevant cross-disciplinary principles of programming in large software packages and software engineering and be able to apply this knowledge for the critical analysis, design, implementation and evaluation of numerical engineering tool chains,
A 3	have obtained a systematic understanding of the principles of optimisation in structures and fluids and be able to apply this knowledge in the critical analysis, implementation and evaluation of optimisation tasks in an industrial context,

Disciplinary Skills - able to:	
B 1	Undertake independent research on a topic related to the relevant Engineering disciplines
B 2	Apply advanced numerical simulation and optimisation methods to a range of Engineering applications
B 3	Optimally select analysis techniques for aircraft and system performance assessment
B 4	Critically assess feasibility of analytical, computational and experimental techniques in use and propose practical methods for their improvement.

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Attributes:	
C1	Engage critically with knowledge.
C2	Be able to understand both the application and limitation of mathematical, computational and experimental techniques available to an engineer.
C3	Undertake independent research using state of the art processing, characterisation and testing facilities.
C4	Research Capacity and Information expertise
C5	Understand the application and use of aerospace technology in related engineering subjects.

How Will You Learn?

Through a wide range of different interactions including lectures, tutorials, laboratory classes, exercise classes and project supervisions. It is expected that the programme will demand between 1800 and 2000 hours in total to complete. About 10% of this time will be in scheduled lectures.
A significant amount of independent personal study is anticipated as part of this programme.

How Will You Be Assessed?

The taught modules will be assessed through both coursework and examinations. The details are as outlined in the individual module specifications. The examinations will all take place in the standard college examination periods in January and May. The final project thesis will be assessed in September and the student will also complete a presentation as well as an oral examination.

How is the Programme Structured?

60 to 75 credits of taught modules will be taught in the first semester from September until December and a further 45 to 60 credits of taught modules will be taught in the second semester from January until April. Overall 120 credits of taught modules have to be taken. All taught module examinations will be in the standard examination periods during January and May.

Sem A, 60-75 credits:
compulsory: DENM014, DENM004,
optional, up to 3 of: DENM512, DENM001, DENM016, DENM033, DENM035, DENM331, DENM208

Sem B, 45-60 credits
compulsory: DENM010, DENM026.
optional, up to 2 of: MTH739N, DENM405, DENM032, DENM011, DENM021, DENM022, DENM012.

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Sem C: 60 credits
DENM027: Computational Engineering research project, which will be completed after the examination period in semester 3 (from June - September). Preparation for this research project will begin in the module on Research Methods, DENM014, taken in the first semester.

Academic Year of Study 1

Module Title	Module Code	Credits	Level	Module Selection Status	Academic Year of Study	Semester
Research Methods and Experimental Techniques in Engineering	DENM014	15	7	Compulsory	1	Semester 1
Computational Engineering	DENM004	15	7	Compulsory	1	Semester 1
Computational Fluid Dynamics	DENM010	15	7	Compulsory	1	Semester 2
Numerical Optimisation	DENM026	15	7	Compulsory	1	Semester 2
Computational Research Project	DENM027	60	7	Core	1	Semesters 1-3
Robotics	DENM011	15	7	Elective	1	Semester 2
Advanced Flight Control and Simulation of Aerospace Vehicles	DENM001	15	7	Elective	1	Semester 1
Vehicular Crashworthiness	DENM033	15	7	Elective	1	Semester 2
Aeroelasticity	DENM032	15	7	Elective	1	Semester 2
Advanced High Speed Aerodynamics	DENM405	15	7	Elective	1	Semester 1
Advanced Environmental Engineering	DENM012	15	7	Elective	1	Semester 2
Bioengineering in Urology	DENM016	15	7	Elective	1	Semester 1
Advanced Heat Transfer and Fluid Mechanics	DENM208	15	7	Elective	1	Semester 1
Renewable Energy Sources	DENM035	15	7	Elective	1	Semester 1
Advanced Combustion in Reciprocating engines.	DENM021	15	7	Elective	1	Semester 2

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Module Title	Module Code	Credits	Level	Module Selection Status	Academic Year of Study	Semester
Advanced Gas Turbines	DENM022	15	7	Elective	1	Semester 2
Topics in Scientific Computing	MTH739N	15	7	Elective	1	Semester 2
Computer Aided Engineering for Solids and Fluids	DENM331	15	6	Elective	1	Semester 1
Grad, Div Curl: Vector Calculus for Engineering	DENM512	15	5	Elective	1	Semester 1

What Are the Entry Requirements?

The entry requirement is that the student to have secured at least a high 2ii (>55%) BEng degree or equivalent qualification in engineering, science or an equivalent academic programme and supporting references.. A minimum of IELTS 6.5 or equivalent is required for non-native English speakers.

How Do We Listen and Act on Your Feedback?

The Staff-Student Liaison Committee provides a formal means of communication and discussion between schools/institutes and its students. The committee consists of student representatives from each year in the school/institute together with appropriate representation from staff within the school/institute. It is designed to respond to the needs of students, as well as act as a forum for discussing programme and module developments. Staff-Student Liaison Committees meet regularly throughout the year.

Each school/institute operates a Learning and Teaching Committee, or equivalent, which advises the School/Institute Director of Taught Programmes on all matters relating to the delivery of taught programmes at school level including monitoring the application of relevant QM policies and reviewing all proposals for module and programme approval and amendment before submission to Taught Programmes Board. Student views are incorporated in the committee's work in a number of ways, such as through student membership, or consideration of student surveys.

All schools/institutes operate an Annual Programme Review of their taught undergraduate and postgraduate provision. APR is a continuous process of reflection and action planning which is owned by those responsible for programme delivery; the main document of reference for this process is the Taught Programmes Action Plan (TPAP) which is the summary of the school/institute's work throughout the year to monitor academic standards and to improve the student experience. Students' views are considered in this process through analysis of the NSS and module evaluations.

Academic Support

During induction the students will be welcomed to the college by the programme leader. Early on in the programme the students will select an project supervisor based upon a wide choice of different project areas. This academic will then also act as a personal tutor. Many of the modules are taught to small classes and so a high level of personal support will also be available from the module organiser in the majority of the taught modules.

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Programme-specific Rules and Facts

The programme follows the standard QMUL guidelines for MSc delivery.

Specific Support for Disabled Students

Queen Mary has a central Disability and Dyslexia Service (DDS) that offers support for all students with disabilities, specific learning difficulties and mental health issues. The DDS supports all Queen Mary students: full-time, part-time, undergraduate, postgraduate, UK and international at all campuses and all sites.

Students can access advice, guidance and support in the following areas:
- Finding out if you have a specific learning difficulty like dyslexia
- Applying for funding through the Disabled Students' Allowance (DSA)
- Arranging DSA assessments of need
- Special arrangements in examinations
- Accessing loaned equipment (e.g. digital recorders)
- Specialist one-to-one "study skills" tuition
- Ensuring access to course materials in alternative formats (e.g. Braille)
- Providing educational support workers (e.g. note-takers, readers, library assistants)
- Mentoring support for students with mental health issues and conditions on the autistic spectrum.

Links With Employers, Placement Opportunities and Transferable Skills

The school has an active Industrial Liaison forum (ILF). This forum has a direct impact on our programmes by encouraging employers to sponsor and support both the students and to provide real design case studies to engage the students throughout the curriculum.

The ILF meets twice a year. The event in October runs in parallel with the SEMS prize day where prospective employers attend the event, meet MSc and final year undergraduate students discussing opportunities and tips for applications. We regularly host employer representatives from the Aerospace sector including Airbus, Alcoa, Astrium, B/E Aerospace, Eaton Aerospace, Marshal Aerospace, Ministry of Defence, Mott McDonald, Price Induction, Rolls Royce and Selex. The new MSc students are encouraged to attend the October event to discuss their projects with industry to forge further ties, where our industrial liaison partners are regularly involved in some of the projects that are of applied research nature. The second industrial forum day takes place in March, where the MSc students are encouraged to meet industrial representatives to discuss potential future employment.

Programme Specification Approval

Person completing Programme Specification	Dr Adrian Briggs
Person responsible for management of programme	Dr Jens Mueller
Date Programme Specification produced/amended by School Learning and Teaching Committee	28 Jan 2019

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Date Programme Specification approved by Taught Programmes Board	11 Apr 2016

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