UNIVERSITY OF LEICESTER

Programme Specification (Postgraduate)
For students entering in 2020/21
Date amended: March 2020

1. Programme Title(s):
MSc Applied Computation and Numerical Modelling with Industry

2. Awarding body or institution:
University of Leicester

3. a) Mode of study
Full time

b) Type of study
Campus-based
The Industrial placement is off campus, on the site of the company concerned.

4. Registration periods:
The normal period of registration is 24 months.
The maximum period of registration is 36 months.

5. Typical entry requirements:
2:2 UG degree in Mathematics, Physics or Engineering from a British university or equivalent as defined under regulations.

Standard College English language requirements, in line with Senate Regulation 1.

6. Accreditation of Prior Learning:
None.

7. Programme aims:
The programme aims to provide a route for students in their transition from undergraduate study to industrial employment. It provides the opportunity to gain practical experience in computational modelling and a rigorous understanding of the mathematics underlying commonly used numerical methods, both within the context of typical industrial applications.

In particular it aims to
- foster confidence, convey knowledge and develop expertise in computational modeling;
- provide an advanced education in the fundamental mathematics of commonly used numerical methods;
- develop the ability to produce rigorous justifications of assertions by logical arguments;
- enhance the ability to model the world using mathematics, and to be able to produce innovative, cost-effective, and robust solutions to real-world problems;
- stimulate intellectual development and hone powers of critical analysis, problem solving, written communication skills and improve presentational skills;
- foster the skill of developing innovative tools
- develop the ability to communicate solutions to problems using language appropriate to any target audience;
- enhance practical computing skills by learning languages and software relevant to industry;
- raise students' expertise and understanding to a point where they could embark upon doctoral interdisciplinary study or enter knowledge-led industrial sectors;
- develop project-management skills
- develop the ability to complete independent project work

8. Reference points used to inform the programme specification:

- QAA Framework for Higher Education Qualifications in England, Wales and Northern Ireland
- QAA Benchmarking Statement Mathematics, Statistics and Operational Research (MMath)
- QAA Annex to subject benchmark statement: Mathematics, statistics and operational research (2009)
- Master's Degree Characteristics
- PDR report (April 2011)
- University Learning Strategy
- University Employability Strategy
- Graduate Survey (2014)
- First Destination Survey
- External Examiner's Reports
- Informal concept document used to aid discussion with partner departments.

9. **Programme Outcomes:**

Intended Learning Outcomes	Teaching and Learning Methods	How Demonstrated?
(a) Subject and Professional skills		
Knowledge		
Advanced knowledge of fundamental theories and techniques for ODE and PDE solutions, and other techniques depending on option choices.	Lectures. Problem classes. Practical sessions. Coursework.	Written examinations. Assessed coursework.
Knowledge and understanding of key techniques and algorithms in numerical modeling. Ability to modify and innovate.	Lectures. Problem classes. Practical sessions. Coursework. Project	Written examinations. Assessed coursework. Project. Written examinations.
Familiarization with common industrial applications of computational modeling and commonly used techniques.	Lectures. Problem classes. Practical sessions. Coursework. Project	Assessed coursework.
Practical knowledge of relevant computing languages (FORTRAN, C, C++, MATLAB), and software where appropriate (FLUENT).	Lectures. Problem classes. Practical sessions. Coursework.	Assessed coursework. Project
In depth practical knowledge and ability to modify numerical software.	Project	

Concepts		
Knowledge of the basics from mathematical physics, including the mathematical setting of many classical PDE problems, derivation of some of them, and their properties.	Lectures. Problem classes. Coursework.	Written examinations. Assessed coursework.
Rigorous understanding of relevant methods for solutions of ODEs and PDEs. Other methods depending on option choices. In particular:	Lectures. Practical sessions. Coursework.	Written examinations. Assessed coursework.
Knowledge of basic functional analysis and its relevance in PDE theory. Rigorous understanding of the mathematical foundation of finite elements error analysis	Lectures. Problem classes. Coursework. (MA7091 only)	Written examinations. Assessed coursework.
Ability to propose standard finite difference schemes for the solution of a given PDE taking into consideration the concepts of consistency, stability, and convergence.	Lectures. Problem classes. Coursework. (MA7011 only)	Written examinations. Assessed coursework. Project (MSc only).
Practical understanding of computational implementation of algorithms for the numerical solution of equations.	Practical sessions. Coursework. Project	Assessed coursework. Project
Techniques		
Ability to code algorithms in a range commonly used languages (FORTRAN, C, C++, MATLAB).	Practical sessions. Project	Assessed coursework. Project
Familiarity with freely available finite element libraries.	Practical sessions. (MA7091 only) Project	Assessed coursework. Project
Ability to develop and apply strategies to solve problems.	Project	Project
Ability to use commonly used commercial software (FLUENT).	Practical sessions. Project	Assessed coursework. Project
Critical analysis		
Analysis of problem and development of appropriate solution strategy. Analyze and solve `messily defined' industrial problems.	Lectures. Problem classes. Feedback on assessed coursework. Project	Written examinations. Assessed coursework. Project
Presentation		
Presentation of concepts, algorithms and solutions.	Practical sessions. Project	Assessed coursework. Project

Intended Learning Outcomes	Teaching and Learning Methods	How Demonstrated?
Appraisal of evidence		
Critical appraisal of algorithms and solutions.	Course work. Project	Written examinations. Assessed coursework. Project
(b) Transferable skills		
Research		
Conduct background research and literature surveys. Summarize content from information sources.	Coursework. Project	Assessed coursework. Project
Communication		
Response to questioning. Scientific communication (written and oral). Project presentation (written and oral.)	Practical sessions. Coursework. Project	Mini-projects. Project. Assessed coursework and mini- projects. Project Assessed coursework. Project
Data presentation		
Project presentation (written and oral.)	Practical sessions. Coursework. Project	Assessed coursework. Project
Information technology		
Various computer languages and specialist software. (FORTRAN, C, C++, MATLAB, FLUENT). Office software.	Throughout. Coursework. Project	Assessed coursework. Project
Problem solving		
Analysis, breakdown, synthesis, critical examination. Computational modeling skills.	Practical sessions. Coursework. Project Coursework. Practical sessions. Project	Written examinations. Assessed coursework. Project Assessed coursework. Project

Working relationships		
Scientific discussion. Awareness of the importance of Health and Safety aspects of the working place; ability to assess dangers associated with the work	Problem classes. Practical sessions. Project Training to fill risk assessment forms, supervised by a mentor.	Project Completed risk assessment form returned to the University
Managing learning		
Study skills. Independence and time management. Information retrieval. Ability to identify key issues affecting the effectiveness of a company by using the internal and external sources of business information.	Throughout. Structured support decreasing through year. Project Coursework. Project Writing summaries about the factors that determine the effectiveness of a company in comparison with other companies. Discussion with a mentor	Written examinations. Assessed coursework. Project Meeting deadlines. Assessed coursework. Project (MSc only). Written summary (at least 200 words).
Career management		
Scientific discussion. Organisation. Time management. Careers and business awareness. Ability to assess training needs and evaluate self-progress	Problem classes. Practical sessions. Project Structured support decreasing through year. Project Industry-led project Discussions with the industrial supervisor and with a mentor.	Project Meeting deadlines. Destination data. Student feedback. Written statements in the student's logbook. Project.

Transferable and practical skills are traditionally developed and assessed during the MSc project. However, the practical nature of this programme means that the majority of modules have the development of such skills implicit within them and incorporated into their coursework assessments (see module specifications). For example, core module PA7081 *Practical Programming* is assessed using three mini-projects. It is clear that exit-award students (PGDip and PGCert) will have been assessed on learning outcomes consistent with those of the MSc project (but on a smaller scale).

10. Special features:

This is an interdisciplinary programme, using expertise from across the College. Emphasis is on the practical implementation and transferable skills in coursework assessment of most modules. Industry-linked MSc projects. Simulated conference to showcase student project work (linked to project assessment).

Placements

Students registered on the 'with Industry' variant of their degree programme undertake an industrial placement after completing the taught modules of their programme and before undertaking the final project/dissertation. The placement must be 12 months in duration.

As a condition of the 'with Industry' programme, students are required to undertake preparatory training during the first year of the degree.

Students are responsible for securing their own placement but will receive support in this from the Career Development Service.

Progression criteria for placements

Students on the "with Industry" programme are subject to the following four progression rules (in addition to any rules applicable to their core programme):

1. If a student:
    a. does not achieve an overall merit level, or;
    b. fails more than 15 credits with a mark of less than 50, or;
    c. fails at least 15 credits with a mark of less than 40,

   they will revert to the degree without industry.

2. If a student fails more than 60 credits at the end of their second semester they will not be able to proceed with the programme, in accordance with Senate Regulation 6.28, and will have to cancel any arrangements made for placements.

3. If a student fails to secure a placement they will revert to the non-industry variant of their degree programme and will continue on to their final project/dissertation.

4. Failure to satisfactorily perform (attendance, participation and completion of set tasks) in the employability modules will lead to the student being transferred to the degree without industry.

In the course of their placement the student will receive one or two support visits from a member of staff. The second 'visit' can be in the form of a Skype call. Typically where an overseas placement is secured both visits will be conducted via a Skype call.

Assessment of the Year in Industry

Students will be required to undertake reflective activities whilst on placement which are marked on a pass/fail basis.

11. Indications of programme quality:
External examiners' reports.

12. Scheme of Assessment
As defined in Senate Regulation 6: Regulations governing Taught Postgraduate Programmes of Study (see Senate Regulations)

13. Progression points

As defined in Senate Regulation 6: Regulations governing Taught Postgraduate Programmes of Study (see Senate Regulations). Please also see Progression criteria for placements above.

In cases where a student has failed to meet a requirement to progress he or she will be required to withdraw from the course and a recommendation will be made to the Board of Examiners for an intermediate award where appropriate.

14. Rules relating to re-sits or re-submissions:

As defined in Senate Regulation 6: Regulations governing Taught Postgraduate Programmes of Study (see Senate Regulations)

15. Additional information

Modules are also taught by the Departments of Informatics, Engineering and Physics.

Former University of Leicester undergraduate students who have taken the equivalent module as part of their undergraduate studies will not be permitted to sit the same module again. An alternative module will be agreed with them on an individual basis.

16. External Examiners

The details of the External Examiner(s) for this programme and the most recent External Examiners' reports can be found here.

Appendix 1: Programme structure (programme regulations)

All programmes to formally include range of non-credit bearing attendance only activities for careers, student support etc.:

MA7903 – House hours

MA7905 - Employability: Core Skills

MA7906 - Employability: Placement Preparation

	Code	Title	Credits
Semester 1			
Core modules			
	PA7081	Practical Programming	15
	MA7012	Scientific Computing	15
Options			
30 credits selected from:			
	MA7032	Equations of Mathematical Physics	15
	EG7026	Advanced Fluid Dynamics	15
	EG7037	Advanced Solid Mechanics	15
	MA7077	Operational Research	15
	PA7111	Scientific Data Analysis	15
	MA7080	Mathematical Modelling	15
Semester 2			
Core modules:			
Either	MA7011	Computational Partial Differential Equations with Applications	15
or	MA7091	Computational Partial Differential Equations with Finite Elements	15
Options			
45 credits selected from:			
	MA7022	Data Mining and Neural Networks	15
	EG7029	Computational Fluid Dynamics	15
	EG7060	Dynamics of Mechanical Systems	15
	EG7016	Design of Discrete Systems	15
	EG7017	Real-time signal processing	15
	MA7061	Topics in Mathematical Biology	15
Summer			
Core modules			
	MA7099	ACNM Project	60
Total			180

Appendix 2: Module Specifications

See module specification database http://www.le.ac.uk/sas/courses/documentation