

MSc by Research in Computational Science

For students entering in October 2009 and February 2010

Awarding Institution:	University of Reading
Teaching Institution:	University of Reading
Faculty of Science	
Programme length:	18 months full time and 24 months part time
Start:	October and February
Date of specification:	September 2009
Programme Director:	Professor Vassil Alexandrov
Board of Studies:	MSc in Computational Science BoS
Accreditation:	

Summary of programme aims

The MSc program by Research in Computational Science aims to provide training for Honours graduates (or “equivalent”) whose career aims include Computational Science in a broad sense with focus through different streams on, High Performance Computing, Business and Engineering and Computational problems in Natural Sciences and Medicine. The programme aims to develop and reinforce the multidisciplinary Computational Science approach to problem-solving; to develop the intellectual and practical skills of the students in recognising, formulating, defining important problems from a multidisciplinary point of view; to devise efficient techniques to solve important scientific and industrial problems on systems ranging from the local cluster to the Grid. Students will be introduced to the specific algorithms and programming environments required to solve large scale problems on supercomputers with thousands on processors. This program will also greatly contribute to the Computational Science research theme and developments in the University of Reading.

Transferable skills covered are teamwork, technical communication (oral and written), project management, project management, risk assessment, efficient deployment of software tools, computer systems evaluation, marketing and business awareness for the streams with more business orientation as well as research and technical writing skills. They are covered in SEMC10 and SEMS93 modules in Part 2.

Programme content

The course content gives a broad and in-depth coverage of state-of-the-art parallel, scientific and Grid computing, including network computing, advanced operating systems, mathematical modelling, advanced algorithms; parallel algorithm design; modern scientific languages; tools and environments for advanced architectures; tools and environments for scientific computation; collaborative computing, scientific visualisation, knowledge discovery, data mining, etc. Graduates, depending on the stream they are selecting will be well equipped to pursue a career in the area of parallel scientific and network computing, any field requiring mathematical modelling of complex systems, or software engineering in industry and/or research respectively.

Part 1

Compulsory Modules

		<i>Credits</i>	<i>Level</i>
SEMC1A	Advanced Operating Systems & Programming on UNIX	10	7
SEMC02	Network Computing	10	7
SEMC33	Advanced Algorithms	10	7
SEMC05	Internet Software Environments	10	7

Optional Modules

Students have to select both modules in one of the following three streams:

High Performance Computing and Communication stream			<i>Credits</i>	<i>Level</i>
SEMS03	Parallel Algorithms		10	7
SEMS04	Programming and Algorithmic Techniques for Advanced Architectures		10	7
Business Modelling stream			<i>Credits</i>	<i>Level</i>
SEMS30	Mathematical Modelling		10	7
SEMS05	Algorithms for Data Mining and Information Retrieval		10	7
Natural Science and Medicine stream			<i>Credits</i>	<i>Level</i>
SEMS30	Mathematical Modelling		10	7
SEMS32	Scientific Visualisation		10	7

Part 2

Compulsory Modules

			<i>Credits</i>	<i>Level</i>
P2	SEMC10	PG Research Skills	10	7
P2	SEMS93	Project Management & Managing IT	10	7
P2	SEMC9A	Research Project	100	7

Modular arrangements

This is a research MSc consisting of part 1: taught component– 60 CATS (30 ECTS) and part 2: taught component– 20 CATS (10 ECTS) and research project worth 100 CATS (50 ECTS).

Part 1 consists of set of four core modules 40 credits (20 ECTS) and three streams, where stream modules for 20 credits (10 ECTS) are selected within the stream in accordance with the options provided.

Part 2 consisting of set of two modules - Postgraduate Research Skills and Project Management and Managing IT totalling 20 credits (10 ECTS) and a research project worth 100 credits (50 ECTS).

Part-time arrangements

The course can be taken part-time for 24 months: 6 months Part1 and 18 months Part2.

Progression Requirements

Progression from Part 1 to Part 2 is determined by the Board of Examiners in accordance with the University Framework for Postgraduate Courses, and it requires achieving mark 50% or more in every taught module.

Summary of teaching and assessment

Teaching in Part 1 is organised in modules lasting one or two weeks. A week long module consists usually of 30 contact hours lectures/practicals (labs) and expects overall work from the student worth 10 credits (5ECTS). Each of these modules last one or two weeks. Assessment is by examination and or coursework - details are given in the relevant module description.

The University's taught postgraduate marks classification is as follows:

Mark Interpretation

70 – 100% Distinction

60 – 69% Merit

50 – 59% Good standard (Pass)

Failing categories:

40 – 49% Work below threshold standard

0 – 39% Unsatisfactory Work

The final award is determined by the Board of Examiners in accordance with the University Framework for Postgraduate Courses where the requirements to qualify for an award of:

- **MSc Degree 180 credits (90 ECTS)**, achieving 60 credits (30 ECTS), with mark 50% or more in every taught module, from Part 1 and 120 credits (60 ECTS) from Part 2, with mark 50% or more in every taught module and 50% mark on the research project;

Students who gain an average mark of 70 or more overall including a mark of 70 or more for the research project and have no mark below 40 will be eligible for a Distinction. Those gaining an average mark of 60-69 overall including a mark of 60 or more for the research project and have no mark below 40 will be eligible for a Merit.

- **PG Diploma (120 credits)** achieving at least 60 credits (30 ECTS) on the taught modules part 1 & 2 with overall mark of 50% or above, and 50% or more on the individual modules. Students who do not satisfy the passing grade for MSc or choose not to proceed to a 100 credits research project, will be allowed to proceed to a Diploma subject to the satisfactory completion of a further program of study and submission of a smaller research project worth of 60 credits (30ECTS) as specified by the Board of Examiners.
- **PG Certificate 60 credits, (30 ECTS)** are the achievement of a mark 50% or more in 3 taught modules – any module from part1 and the two modules from part 2 and 50% mark from a 30 credits research project (normally for three months);

Overall examination result	Usual recommendation
50% or more on each module on 8 modules (part1 & 2) and research project (100 credits – SEMC9A)	MSc Degree
50% or more on each module on 6 modules (any 4 from part 1 and 2 modules from part 2) and research project (60 credits – SEMC8A)	PG Diploma
50% or more on each module on 3 modules (any one from part 1 and 2 modules from part 2) and research project (30 credits – SEMC7B)	PG Certificate
Not satisfying the above criteria	Fail

Admission requirements

Entrants to this programme are normally required to have obtained:

First Cycle Degree in Sciences, e.g. BSc, BEng or other: A good honours degree with sufficient mathematical content and computing experience or equivalent qualification and background as

approved by the University. Typically, graduates in Computer Science, Cybernetics, Engineering, Mathematics and Physics, or in joint Mathematics/Computer Science will be acceptable.

First Cycle Degree with non-science background or Graduates in other disciplines may be admitted to the programme if their level of computing and mathematical experience as approved by the University will be acceptable.

Admissions tutor: Dr. Gerard McKee

Support for students and their learning

University support for students and their learning falls into two categories. Learning support includes IT Services, which has several hundred computers and the University Library, which across its three sites holds over a million volumes, subscribes to around 4,000 current periodicals, has a range of electronic sources of information and houses the Student Access to Independent Learning (S@IL) computer-based teaching and learning facilities. There are language laboratory facilities both for those students studying on a language degree and for those taking modules offered by the Institution-wide Language Programme.

Student guidance and welfare support is provided by Personal Tutors, School Senior Tutors, the Students' Union, the Medical Practice and the Student Services Centre. The Student Services Centre is housed in the Carrington Building and includes the Careers Advisory Service, the Disability Advisory Service, Accommodation Advisory Team, Student Financial Support, Counselling and Study Advisors. Student Services has a Helpdesk available for enquiries made in person or online (www.risisweb.reading.ac.uk), or by calling the central enquiry number on (0118) 378 5555. Students can get key information and guidance from the team of Helpdesk Advisers, or make an appointment with a specialist adviser; Student Services also offer drop-in sessions on everything from accommodation to finance. The Carrington Building is open between 8:30 and 17:30 Monday to Thursday (17:00 Friday and during vacation periods). Further information can be found in the Student Diary (given to students at enrolment) or on the Student website (www.reading.ac.uk/student).

Career prospects

The program is an example of the collaboration with industry in creating a model ICT curricula through the Career Space consortium (www.career-space.com). Different streams are focused on different job profiles:

- High Performance Computing and Communication is focused toward following job profiles: *Research and Technology Development, Systems Specialist, Network Design and Grid Computing, Software Architecture and Design, DSP Applications Design, Integration/Implementation & Test Engineering.*
- Natural Sciences and Medicine is focused towards job profiles: *in the multidisciplinary research, design and development, in particular specialists in modelling of complex systems: Mathematical Modelling, Data Visualisation, Algorithms Design and Implementation, Grid Computing, Integration/Implementation.*
- Business Modelling is focused towards following job profiles: *Mathematical Modelling, Software Architecture and Design, Systems Specialist, Software & Applications Development, Data Analysis and Mining, IT Business Consultancy, Product Design.*

Educational aims of the programme

The MSc in Computational Science by research aims to teach the students of the new way to conduct multidisciplinary research based on advanced computing techniques, where the network is the computer and enabling “scientific discovery through advanced computing” and focusing on High Performance Computing and Communication, Business and Modelling, and Natural Science and Medicine.

The main aims are:

- To prepare students for critical evaluation of large scale problems, to efficiently deploy theory and modelling techniques to such problems, to develop efficient algorithms to tackle large scale problems and to develop and use efficient tools visualisation and collaboration.
- To prepare students for teamwork
- To prepare students for employment focusing the program to set of job profiles as described above.

Programme Outcomes

Knowledge and Understanding

A. Knowledge and understanding of:	Teaching/learning methods and strategies
<ul style="list-style-type: none">i. Understanding how to solve complex industrial and scientific problems in a networked environmentii. Algorithmic thinking, advanced models of computation, analysis of algorithms, techniques for its estimation and measurement, existence of intractable problemsiii. Knowledge of advanced modelling techniquesiv. Knowledge of advanced programming and communication techniques for networked architecturesv. Knowledge of Web based systems and building Web applicationsvi. Specific body of computational science related knowledge through specialized modules.	<p>Acquisition of knowledge is achieved through lectures, practicals and seminars. More advanced knowledge and concepts are gained based on the above techniques and through teamwork, team projects, and individual projects and directed and self-paced study and learning.</p> <p>Assessment Assessment methods are specified for each module. There are exams, project assignments, oral presentations and Dissertation.</p>

<p>B. Intellectual skills – able to:</p> <ul style="list-style-type: none"> i. Integration of Theory and practice ii. Critical evaluation of software environments, their limitations and suggest improvements iii. Synthesise information from data for decision making iv. Advanced decision making v. Demonstrate skill necessary to plan and conduct advanced research vi. Demonstrate ability to understanding and explain advanced concepts, principles and theory related to Computing Applications and Computational Science 	<p>Teaching/learning methods and strategies</p> <p>Project work, tutorials, seminars and coursework assignments. Open-ended project work is permitting the students to demonstrate the achievements of all learning outcomes in this category.</p> <p>Assessment</p> <p>Through formal examination, coursework and practical and project work. Methods for assessment are: research reports, essays, oral presentations open and closed book examination.</p>
<p>C. Practical skills – able to:</p> <ul style="list-style-type: none"> i. Critically evaluate the problems and choose appropriate methods and algorithms for their efficient solution. ii. Applying advanced methods and techniques for solving complex problems iii. Use advanced theories and concepts to explain complex processes iv. Manage practical projects efficiently v. Consider and analyse the problem to be solved from multidisciplinary point of view. vi. Efficiently deploy appropriate theory, practices and tools necessary for solving large scale computing problems 	<p>Teaching/learning methods and strategies</p> <p>Practical skills are developed through a practical project work, tutorials and course work assignments. Especially the open-ended project and practical work is designed to permit students to show achievement of all the learning outcomes in this category.</p> <p>The skills are taught embedded as integral part of various modules.</p> <p>Assessment</p> <p>The skills are assessed via the course work assessment as parts of the mark are awarded for achieving a level of skill appropriate for a postgraduate student (as recommended by the professional bodies in the field).</p>
<p>D. Transferable skills – able to:</p> <ul style="list-style-type: none"> i. Capacity to learn intensively ii. Capacity to communicate efficiently by written and verbal means iii. To write research reports and papers iv. To do efficient search of information and select the relevant one. v. Problem solving skills vi. Ability to work as part of a team vii. Ability to work independently viii. Project planning and time/task management through individual/team project 	<p>Teaching/learning methods and strategies</p> <p>A separate module on Transferable Skills which includes lectures, practical exercises, formal oral presentations and written assignments. These skills are further developed throughout the programme through assignments, team projects and team work as well as tutorial and seminar work.</p> <p>Assessment</p> <p>Coursework assignments, Essays, Technical Reports, Seminars and Formal Presentations.</p>

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. More detailed information on the learning outcomes, content and teaching, learning and assessment methods of each module can be found in the module description and in the programme handbook. The University reserves the right to modify this specification in unforeseen circumstances, or where the process of academic development and feedback from students, quality assurance processes or external sources, such as professional bodies, requires a change to be made. In such circumstances, a revised specification will be issued.