

MSc in Network Centred Computing (NCC)

For students entering in 2008

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| Awarding Institution: | The University of Reading |
| Teaching Institution: | The University of Reading, Faculty of Science With contributions from other EU universities |
| Programme length: | 12 months full-time, 24 months part-time |
| Date of specification: | 30/10/2007 |
| Programme Director: | Professor Vassil Alexandrov |
| Board of Studies: | MSc in Network Centred Computing BoS |
| Accreditation: | Not applicable |

Summary of programme aims

The Advanced European MSc program in NCC aims to provide training for Honours graduates (or "equivalent") whose career aims include Network Centred Computing in a broad sense with focus through different streams on, High Performance Computing and Communication, Computational Sciences, Data Communications and Networking, Cybernetics, E-commerce or Software Engineering & HCI. This is a two semester European program consisting of six months taught component (part 1) and 6 months project placement (part 2).

The programme aims to develop and reinforce the net-centric approach to problem-solving; to develop the intellectual and practical skills of the students in recognising, formulating, defining important problems from 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.

Transferable skills covered are personal effectiveness, interpersonal skills, teamwork, technical communication (oral and written) and interview techniques, project management, self-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..

Programme content

The course content gives a broad and in-depth coverage of state-of-the-art parallel, scientific and network computing, including computer architectures; parallel algorithm design; modern scientific languages; tools and environments for advanced architectures; tools and environments for network-centred computing; tools and environments for scientific computation; collaborative computing and virtual reality, e-payments and security, scientific foundations of image processing and computer vision, knowledge discovery, data mining and web development, etc.

Graduates, depending on the stream they are selecting will be well equipped to pursue a career in the area of e-business and mobile computing, parallel scientific and network computing, or software engineering in industry and/or research respectively.

CORE MODULES

| | | <i>Credits</i> | <i>Level</i> |
|-----------|---|----------------|--------------|
| SEMC1A | Advanced Programming on UNIX | 10 | M |
| SEMC02 | Network Computing | 10 | M |
| SEMC03 | Computer Architectures | 10 | M |
| SEMC04 | Object Oriented Design | 10 | M |
| SEMC05 | Internet Computing Environments | 10 | M |
| SEMC06 | Transferable Skills | 10 | M |
| MAMB6 | Industrial Mathematics (assessed as part of SEMC06) | non-credited | M |
| SEMC7A/7B | Dissertation Project | 90/30 | M |

Science:

High Performance Computing and Communication stream*Credits Level**And 6 out of the following*

| | | | |
|--------|---|----|---|
| SEMS1A | Linear Algebra – part 1 | 10 | M |
| or | | | |
| SEMS05 | Algorithms for Data Mining and Information Retrieval | | M |
| or | | | |
| SEMS04 | Programming and Algorithmic Techniques for Advanced Architectures | 10 | M |
| or | | | |
| SEMS03 | Parallel Algorithms | 10 | M |
| or | | | |
| SEMS02 | Scientific Foundations of Digital Image Processing | 10 | M |
| or | | | |
| SEMS06 | Broadband Communication/ATM | 10 | M |
| or | | | |
| SEMS23 | Wireless Local Area Networks | 10 | M |
| or | | | |
| SEMS07 | Collaborative Virtual Environments | 10 | M |
| or | | | |
| SEMS1B | Linear Algebra – part 2 | 10 | M |
| or | | | |
| SEMS16 | Networked Robotics | 10 | M |
| or | | | |
| SEMS30 | Mathematical Modelling | 10 | M |
| or | | | |
| SEMS32 | Scientific Visualisation | 10 | M |
| or | | | |
| MAMC6 | Modelling Week | 10 | M |

*Credits Level***Computational Sciences stream***And 6 out of the following*

| | | | |
|--------|---|----|---|
| SEMS1A | Linear Algebra – part 1 | 10 | M |
| or | | | |
| SEMS30 | Mathematical Modelling | 10 | M |
| or | | | |
| SEMS03 | Parallel Algorithms | 10 | M |
| or | | | |
| SEMS04 | Programming and Algorithmic Techniques for Advanced Architectures | 10 | M |
| or | | | |
| SEMS05 | Algorithms for Data Mining and Information Retrieval | 10 | M |
| or | | | |
| SEMS13 | Stochastic Methods and Algorithms for Computational Science | 10 | M |
| or | | | |
| SEMS1B | Linear Algebra – part 2 | 10 | M |
| or | | | |
| SEMS31 | Differential Equations | 10 | M |
| or | | | |
| SEMS32 | Scientific Visualisation | 10 | M |
| or | | | |

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|--------|------------------------|----|---|
| SEMS16 | Networked Robotics | 10 | M |
| or | | | |
| SEMS26 | Intelligent Robotics | 10 | M |
| or | | | |
| MAMB3 | Finite Element Methods | 10 | M |
| or | | | |
| MAMC6 | Modelling Week | 10 | M |

Engineering:

Data Communication and Networking stream *Credits Level* *And 6 out of the following*

| | | | |
|--------|--|----|---|
| SEMS28 | Data Protocols | 10 | M |
| or | | | |
| SEMS06 | Broadband Communication/ATM | 10 | M |
| or | | | |
| SEMS23 | Wireless Local Area Networks | 10 | M |
| or | | | |
| SEMS25 | Web Services | 10 | M |
| or | | | |
| SEMS27 | Introduction to Data Communications and Networks | 10 | M |
| or | | | |
| SEMS16 | Networked Robotics | 10 | M |
| or | | | |
| SEMS08 | Network Security and E-Payment | 10 | M |
| or | | | |
| SEMS29 | Modelling of Communication Systems | 10 | M |
| or | | | |
| SEMS32 | Scientific Visualisation | 10 | M |

Advanced Cybernetics stream *Credits Level* *And 6 out of the following*

| | | | |
|--------|---|----|---|
| SEMS19 | Bionic Systems | 10 | M |
| or | | | |
| SEMS20 | Mind as Motion: Dynamical Foundations of Intelligence | 10 | M |
| or | | | |
| SEMS02 | Scientific Foundations of Digital Image Processing | 10 | M |
| or | | | |
| SEMS05 | Algorithms for Data Mining and Information Retrieval | 10 | M |
| or | | | |
| SEMS21 | Advanced Control | 10 | M |
| or | | | |
| SEMS22 | Advanced Instrumentation | 10 | M |
| or | | | |
| SEMS18 | Manipulator Robotics | 10 | H |
| or | | | |
| SEMS07 | Collaborative Virtual Environments | 10 | M |
| or | | | |
| SEMS16 | Networked Robotics | 10 | M |
| or | | | |

| | | | |
|--------|------------------------------|----|---|
| SEMS26 | Intelligent Robotics | 10 | M |
| or | | | |
| SEMS23 | Wireless Local Area Networks | 10 | M |

Business:

| Electronic Business stream | | <i>Credits</i> | <i>Level</i> |
|-----------------------------------|--|----------------|--------------|
| <i>And 6 out of the following</i> | | | |
| SEMS14 | Databases & Advanced DBMS | 10 | M |
| or | | | |
| SEMS05 | Algorithms for Data Mining and Information Retrieval | 10 | M |
| or | | | |
| SEMS25 | Web Services | 10 | M |
| or | | | |
| SEMS12 | E-commerce web Development | 10 | M |
| or | | | |
| SEMS24 | Implementation of Learning Technologies | 10 | M |
| or | | | |
| SEMS08 | E- Payment & Security | 10 | M |
| or | | | |
| SEMS07 | Collaborative Virtual Environments | 10 | M |
| or | | | |
| SEMS15 | GUI/Web Design | 10 | M |
| or | | | |
| SEMS23 | Wireless Local Area Networks | 10 | M |
| or | | | |
| SEMS11 | E-Marketing & Information Design | 10 | M |
| or | | | |
| SEMS32 | Scientific Visualisation | 10 | M |

| Software Engineering and HCI stream | | <i>Credits</i> | <i>Level</i> |
|--|--|----------------|--------------|
| <i>And 6 out of the following</i> | | | |
| SEMS17 | Computer Graphics | 20 | M |
| or | | | |
| SEMS15 | GUI/Web Design | | M |
| or | | | |
| SEMS07 | Collaborative Virtual Environments | 10 | M |
| or | | | |
| SEMS09 | Multimedia Software Engineering | 10 | H |
| or | | | |
| SEMS05 | Algorithms for Data Mining and Information Retrieval | 10 | M |
| or | | | |
| SEMS06 | Broadband Communication/ATM | 10 | M |
| or | | | |
| SEMS02 | Scientific Foundations of Digital Image Processing | 10 | M |
| or | | | |
| SEMS23 | Wireless Local Area Networks | 10 | M |
| or | | | |
| SEMS32 | Scientific Visualisation | 10 | M |

Modular arrangements

This is a modular program of one and two week long modules by design. Part 1 consists of set of six core modules 60 credits and six streams, where stream modules for 60 credits or more are selected within the stream in accordance with the options provided. There are options offered only for specific stream and others offered across several or all the streams. A week module consists usually of 30 contact hours lectures/practicals (labs) and expects overall work from the student worth 10 credits.

Part 2 consists of 6 months project placement culminating with written Dissertation worth 90 credits.

Part-time

Part-time option is available over 2 years. The taught component (Part 1- 12 modules with pass mark) is expected to be taken during the first 12/18 months and since the program has two intakes, October and February, these modules can be taken in flexible way.

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 (SECTS). 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 (210 credits)**, achieving 120 credits (mark 50% or more in every taught module) from the taught part (Part1) and 90 credits from the Dissertation (Part 2);

Students who gain an average mark of 70 or more overall including a mark of 60 or more for the dissertation and have no mark below 40 will be eligible for a Distinction. Those gaining an average mark of 60 or more overall including a mark of 50 or more for the dissertation and have no mark below 40 will be eligible for a Merit.

- **PG Diploma (120 credits)** achieving at least 90 credits on the taught part 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 90 credits dissertation, will be allowed to proceed to a Diploma subject to the satisfactory completion of a further

program of study (normally for three months) and submission of a "Mini-dissertation" worth of 30 credits as specified by the Board of Examiners.

- **PG Certificate (60 credits)** are the achievement of a mark 50% or more in every taught module;

| Overall examination result | Usual recommendation |
|---|----------------------|
| 50% or more on each module on 12 modules (Part 1) and MSc Dissertation (90 credits) | MSc Degree |
| 50% or more on each module on 9 modules (Part 1) and "Mini-dissertation" (30 credits) | PG Diploma |
| 50% or more on each module on 6 modules | PG Certificate |
| 49% or less on more than 6 modules | 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 experience as approved by the University are acceptable.

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 Programme Directors, the Careers Advisory Service, the University's Special Needs Advisor, Study Advisors, Hall Wardens and the Students' Union.

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.*
- Computational Sciences is focused towards job profiles: *in the multidisciplinary research, design and development, in particular specialists in Mathematical Modelling, Data Visualisation, Algorithms Design and Implementation, Grid Computing, Integration/Implementation & Test Engineering.*

- Data Communications and Networking is focused towards job profiles: *DSP Applications Design, Communications Network Design, Data Communications Engineering, Integration/Implementation & Test Engineering.*
- Electronic Business is focused towards following job profiles: *Software Architecture and Design, Systems Specialist, Communications Network Design, Software & Applications Development, Multimedia Design, Data Communications Engineering, IT Business Consultancy, Product Design.*
- Software Engineering and HCI is focused towards following job profiles: *Software Architecture and Design, Systems Specialist, Communications Network Design, Multimedia Design, Software & Applications Development, IT Business Consultancy, Technical Support, Product Design, Integration/Implementation & Test Engineering.*
- Advanced Cybernetics is focused towards specific job profiles requiring advanced cybernetics subject areas knowledge and expertise.

Opportunities for study abroad or for placements

Study abroad is through exchange with our EU partners through the EC ERASMUS program and/or on individual basis as far as student project placements are concerned.

Educational aims of the programme

The Advanced European MSc program in Network Centred Computing takes a net-centric approach and 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, E-commerce, Software Engineering & HCI, and Cybernetics.

The main aims are:

- To prepare students for critical evaluation and testing of computer systems, to efficiently deploy theory, practices and tools for the specification, and implementation of complex computer systems.
- To Prepare students for teamwork
- To Prepare students for employment focusing the program to set of job profiles as described in Career Space consortium.
- To enable students to engage in life-long learning.

Programme Outcomes

Knowledge and Understanding

| | |
|---|--|
| A. Knowledge and understanding of: <ul style="list-style-type: none">□ Understanding how to solve complex scientific problems in a networked environment□ Algorithmic thinking, advanced models of computation, analysis of algorithms complexity, techniques for its estimation and measurement, existence of intractable problems□ Knowledge of advanced programming and communication techniques for networked architectures□ Knowledge of Web based systems and building Web applications□ Multimedia data technologies□ Network security□ Wireless and mobile computing□ Specific body of knowledge through each stream such as: E-payments, Computer Graphics Techniques, Advanced Instrumentation etc. | Teaching/learning methods and strategies <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> Assessment <p>Assessment methods are specified for each module. There are exams, project assignments, oral presentations and Dissertation.</p> |
|---|--|

Skills and other attributes

| | |
|--|--|
| B. Intellectual skills – able to: <ul style="list-style-type: none">□ Integration of Theory and practice□ Critical evaluation software environments, their limitations and suggest improvements□ Synthesise information from data for decision making□ Advanced decision making□ Analyse results of advanced computational experiments□ Demonstrate skill necessary to plan and conduct advanced research□ Demonstrate ability to understanding and explain advanced concepts, principles and theory related to Network Centered Computing and Computing Applications | Teaching/learning methods and strategies <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> Assessment <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> |
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| <p>C. Practical skills – able to:</p> <ul style="list-style-type: none"> <input type="checkbox"/> Critically evaluate the problems and choose appropriate methods and algorithms for their efficient solution. <input type="checkbox"/> Applying advanced methods and techniques for solving complex problems <input type="checkbox"/> Use advanced theories and concepts to explain complex processes <input type="checkbox"/> Manage practical projects efficiently <input type="checkbox"/> Consider and analyse the problem to be solved from multidisciplinary point of view. <input type="checkbox"/> Evaluate and analyse the outcomes of computational experiment. <input type="checkbox"/> Write an efficient complex piece of code. <input type="checkbox"/> Efficiently deploy appropriate theory, practices and tools for the design, evaluation and implementation of computer systems | <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 achievements of all the learning outcomes in this category.</p> <p>The skills are taught embedded as integral part of various modules.</p> <p>Assessment 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"> <input type="checkbox"/> Capacity to learn intensively <input type="checkbox"/> Capacity to communicate efficiently by written and verbal means <input type="checkbox"/> To write research reports and papers <input type="checkbox"/> To do efficient search of information and select the relevant one. <input type="checkbox"/> Problem solving skills <input type="checkbox"/> Ability to work as part of a team <input type="checkbox"/> Ability to work independently <input type="checkbox"/> 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 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.