

MSc in Network Centred Computing (NCC) For students entering in 2007-08

Awarding Institution:

Teaching Institution:

Faculty of Science

Date of specification: 20/09/2007 updated 30/10/2007

Programme Director: Professor Vassil Alexandrov

Board of Studies: MSc in Network Centred Computing BoS

Accreditation:

The University of Reading

The University of Reading, with
contributions from other EU
universities

Programme length: 12 months full-
time, 24 months part-time

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			
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			

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 (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 (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

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

<p>B. Intellectual skills – able to:</p> <ul style="list-style-type: none"><input type="checkbox"/> Integration of Theory and practice<input type="checkbox"/> Critical evaluation software environments, their limitations and suggest improvements<input type="checkbox"/> Synthesise information from data for decision making<input type="checkbox"/> Advanced decision making<input type="checkbox"/> Analyse results of advanced computational experiments<input type="checkbox"/> Demonstrate skill necessary to plan and conduct advanced research<input type="checkbox"/> Demonstrate ability to understanding and explain advanced concepts, principles and theory related to Network Centered Computing and Computing Applications	<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>
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C. Practical skills – able to:

- Critically evaluate the problems and choose appropriate methods and algorithms for their efficient solution.
- Applying advanced methods and techniques for solving complex problems
- Use advanced theories and concepts to explain complex processes
- Manage practical projects efficiently
- Consider and analyse the problem to be solved from multidisciplinary point of view.
- Evaluate and analyse the outcomes of computational experiment.
- Write an efficient complex piece of code.
- Efficiently deploy appropriate theory, practices and tools for the design, evaluation and implementation of computer systems

Teaching/learning methods and strategies

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.

The skills are taught embedded as integral part of various modules.

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).

D. Transferable skills – able to:

- Capacity to learn intensively
- Capacity to communicate efficiently by written and verbal means
- To write research reports and papers
- To do efficient search of information and select the relevant one.
- Problem solving skills
- Ability to work as part of a team
- Ability to work independently
- Project planning and time/task management through individual/team project

Teaching/learning methods and strategies

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.

Assessment

Coursework assignments, Essays, Technical Reports, Seminars and Formal Presentations.

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.