

## Modular Masters Programme in Computer Science

<b>Awarding Institution/Body</b>	University of Hertfordshire
<b>Teaching Institution</b>	IST Studies / Athens
<b>Programme accredited by</b>	British Computer Society
<b>Final Award</b>	MSc
<b>All Final Award titles</b>	MSc Distributed Systems and Networks MSc Software Engineering MSc Distributed Data Management MSc Mobile Computing MSc Computer Science MSc Computer Networking Principles and Practice MSc Secure Computing Systems MSc Multimedia Technology
<b>FHEQ level of award</b>	Masters (M)

### Programme Rationale

The Programme is intended for three classes of Honours graduates: those who have a recent Honours degree in Computer Science (or equivalent), those who obtained an Honours degree in Computer Science (or equivalent) some years ago, and those who have an Honours degree in a non-computer science (or equivalent), but who have some level of computer literacy.

The strategy for dealing with students without a degree in computer science (or equivalent) is to rapidly bring them up to a sufficient standard over a narrow front so that they can study effectively a subset of the modules offered on the Programme. The skills chosen for rapid development are in the area of problem analysis, system design and implementation, and professional issues. Entrants who have benefited from relevant experiential learning may have a greater selection of modules for study.

The strategy for dealing with students with an Honours degree in Computer Science (or equivalent) obtained some years ago is to offer a tailored subset of the introductory modules designed for non-computing entrants to rectify dated knowledge.

Entrants with an Honours degree in Computer Science (or equivalent) will be eligible to take all taught modules offered by the Programme, (source: UH Modular MSc Programme Specification).

## Educational Aims of the Programme

The programme has been devised in accordance with the University's general educational aims of programmes of study as set out in UPR AS/C/3 (2006).

- **Additionally this programme aims to provide students with opportunities to:**
  - build upon their existing degree-level knowledge and/or practical experience;
  - undertake a substantial programme of individual investigative and practical work at postgraduate level;
  - evaluate and further develop their skills in research, independent study and self-management, and prepare themselves for lifelong learning;
  - acquire the necessary skills to undertake further research or secure employment in their chosen career.
  
- For the MSc Distributed Systems and Networks to provide students with opportunities to:
  - gain an awareness of current research in the areas of distributed systems and networks;
  - develop the ability to respond to rapid technological change in the area of distributed systems and networks;
  - critically apply the theoretical aspects of distributed systems and networks to specific case studies as examples of networks or distributed systems
  
- For the MSc Software Engineering, to provide the students with the opportunity to:
  - develop awareness of current research and practice in software engineering;
  - extend theoretical knowledge and practical skills of models, methodologies, measures and tools that can be employed in the software engineering process;
  - apply and critically evaluate a variety of software engineering practices.
  
- For the MSc Distributed Data Management, to provide students with opportunities to:
  - extend and critically evaluate the theoretical knowledge and practical skills that are needed to contribute to the design and implementation of working data intensive systems;
  - extend and critically evaluate their knowledge of the scope and limitations of different data modelling paradigms and their definitions and implementations within and between enterprises;
  - use and critically evaluate data models in advanced contexts such as defining distributed access to data and meta-data.

- For the MSc Mobile Computing, to provide students with opportunities to:
  - gain the ability to evaluate and apply emerging technologies for the creation of novel multi-user distributed applications;
  - become familiar with the principles behind a range of mobile network technologies;
  - apply and evaluate the canons of traditional software development such as usability engineering and requirements specification to mobile devices;
  - explore the potential for innovative and imaginative applications in the mobile technology field;
  - develop an appreciation of the “social” in mobile computing;
  - extend knowledge of the major development platforms particularly suitable for mobile computing and evaluate their specific characteristics.
  
- For the MSc Computer Science, to provide students with opportunities to:
  - extend knowledge and understanding of, and practical skills in, a range of advanced computer science topics.
  
- For the MSc Computer Networking Principles and Practice, to provide students with opportunities to:
  - extend theoretical knowledge in a range of networking technologies;
  - extend technical expertise and practical skills in aspects of designing and managing real networks and to critically evaluate these;
  - extend knowledge of, and critically evaluate, the principles that underpin current and future developments in the networking field.
  
- For the MSc Secure Computing Systems, to provide students with opportunities to:
  - gain familiarity with relevant research relating to system security;
  - extend knowledge of, and critically evaluate techniques and tools employed in system security;
  - extend awareness of the relative strengths and weaknesses of a range of programming language and software features from a security perspective.
  
- For the MSc Multimedia Technology, to provide students with opportunities to:
  - develop the ability to respond to rapid technological change in the area of multimedia technology;
  - gain an awareness of current research in the area of multimedia technology;
  - Critically apply the theoretical aspects of multimedia technology to the design, practical development and implementation of multimedia computer systems.

(source: UH Modular MSc Programme Specification).

## Programme Structure

			AWARDS							
Modules			Multimedia Technology	Distributed Systems & Networks	Software Engineering	Distributed Data Management	Mobile Computing	Computer Science	Computer Networking Principles & Practice	Secure Computer Systems
Module Name	Short Name	Credits	MT	DSN	SE	DDM	MC	CS	NPP	SCS
Neural Networks Evolutionary Computation & Robotics	NNEC	30	0	0	0	0	0	0	0	0
Distributed Systems & Security	DSS	30	0	C	0	0	0	0	0	C
Wireless, Mobile and Ad-hoc Networking	WBN	15	C	C	0	0	C	0	C	0
Multicast and Multimedia Networking	MMN	15	C	C	0	0	C	0	C	0
Measures & Models for Software Engineering	MMSE	30	0	0	C	0	0	0	0	0
Software Engineering Practise & Experience	SE P&E	30	0	0	C	0	0	0	0	0
Advance Databases	ADB	30	0	0	0	C	0	0	0	0
Web Services	WS	30	0	0	0	C	0	0	0	0
Multimedia Specification Design & Production	MSDP	30	C	0	0	0	0	0	0	0
Mobile Standards Interfaces & Applications	MSIA	15	0	0	0	0	C	0	0	C
Network System Administration	NSA	15	0	0	0	0	0	0	C	C
Secure Systems Programming	SSP	15	0	0	0	0	C	0	C	0
Introduction to Programming	ITP	15	0	0	0	0	0	0	0	0
Object Oriented Programming	OOP	15	0	0	0	0	0	0	0	0
Software Development Tools & Methods	SDTM	15	0	0	0	0	0	0	0	0
Professional Issues	PI	15	0	0	0	0	0	0	0	0
Subject Specific MSc Project		60	C	C	C	C	C	C	C	C

C: indicates a core module O: indicates an optional module

The award of an MSc degree requires 180 credit points with at least 150 points passed at level M. Plus that all modules listed above as core for the chosen award title and the Project module should be passed without compensation.

## Progression

To proceed to the Project, students must have been referred in no more than 60 credits.

## Passing Conditions for each module

Module Name	Credits	% Exams	% Coursework
Neural Networks Evolutionary Computation & Robotics	30	0	100
Distributed Systems & Security	30	100	0
Wireless, Mobile and Ad-hoc Networking	15	70	30
Multicast and Multimedia Networking	15	75	25
Measures & Models for Software Engineering	30	0	100
Software Engineering Practise & Experience	30	0	100
Advance Databases	30	67	33
Web Services	30	67	33
Multimedia Specification Design & Production	30	0	100
Mobile Standards Interfaces & Applications	15	0	100
Network System Administration	15	0	100
Secure Systems Programming	15	70	30
Introduction to Programming	15	0	100
Object Oriented Programming	15	67	33
Software Development Tools & Methods	15	50	50
Professional Issues	15	50	50

## Interim Awards

The programme provides the following interim awards:

Award	Minimum requirements	Available at end of (normally):
Postgraduate Certificate	60 credit points, including at least 30 at level M	depends on mode of study
Postgraduate Diploma	120 credit points, including at least 90 at level M. Plus that all modules listed above as core for the chosen award title should be passed without compensation.	depends on mode of study

The titles of Postgraduate Diploma awards are decorated with subject specialisms as listed below.

Postgraduate Diploma Distributed Systems and Networks,  
Postgraduate Diploma Software Engineering,  
Postgraduate Diploma Distributed Data Management,  
Postgraduate Diploma Mobile Computing,  
Postgraduate Diploma Computer Science,  
Postgraduate Diploma Computer Networking Principles and Practice,  
Postgraduate Diploma Secure Computing Systems, or  
Postgraduate Diploma Multimedia Technology.

Masters and Diploma awards can be made "with Distinction" or "with Commendation" where criteria as described in UPR AS/C/5 and the students' handbook are met.

## Entry requirements

The principal criterion for admission to the Programme will be the applicants' ability to succeed at, and benefit from, one or more awards of the Programme.

For guidance purposes, the normal entry requirements for the Programme are:

- a recent Honours Degree in Computer Science (or equivalent),
- a less recent Honours Degree in Computer Science (or equivalent),
- an Honours Degree in a non-CS subject combined with some level of computer literacy.

Entrants with a recent Honours Degree in Computer Science (or equivalent) may be registered for any one of the awards provided by the Programme.

Other qualified entrants may normally be registered for the awards of:

- MSc Software Engineering, or
- MSc Computer Science,

Depending on the award concerned, and the computing background of the entrant, he or she may be required to take some or all of the modules:

- Introduction to Programming,
- Object-oriented Programming,
- Software Development Tools and Methods.

Entrants without a recent Honours Degree in Computer Science (or equivalent) may be registered for other awards, dependent on the extent of their computing background.

## Period and mode of Study

The programme is offered either in a full time or a part time mode.

Mode	Taught Credits per academic Year	MSc Project duration
Full time	120	1 semester
Part time	60	1 academic year

The duration of study may not exceed four years. This period could be extended in the case a student has to perform his military service.

## Module Description

### **Introduction To Programming**

This module introduces the basic facilities found in imperative and object-oriented programming languages, and develops the skills needed to use such languages to build and verify high quality programs to solve clearly-specified problems. It assumes no previous programming experience, and uses a practical approach, and up-to-date tools, to explore the basic principles underlying modern approaches to program development.

### **Object-oriented Programming**

This module explores the use of object-oriented methods and tools in the design and implementation of software systems, particularly the appropriate use of inheritance to support code reuse and to promote flexible designs. Practical work involves these and other advanced features of modern programming languages (such as programming graphical user interfaces, using threads, and using generic library classes).

The module assumes some prior programming experience and an understanding of basic object-oriented concepts.

### **Secure Systems Programming**

The variety and proliferation of passive and active malicious attacks made against users of networks and distributed systems has led to a need for pro-active defence mechanisms against such attackers. For an individual, the inconvenience of being attacked can range from being extremely frustrating to downright expensive with slow to no service at all on their computer. For a company it too can be frustrating and costly both financially and to their reputation. This module will be both theoretical and practical, exploring concepts and applications from the fields of computer systems and their security weaknesses. Content will vary according to current research directions.

### **Professional Issues**

This module provides a broad understanding of information systems (IS) project management. The module will look at the various IS development methodologies in use and will cover project control activities and techniques including- estimation of development resources, risk management, systems quality assurance and human resource management. This module also covers the relationship between technological change, society and the law, emphasising the powerful role that computers and computer professionals play in a technological society. It also covers the laws in UK which are relevant to the discipline of computer science, and an understanding of important ethical concepts and dilemmas of relevance to computer professionals.

### **Network System Administration**

This module is primarily designed for those with an existing knowledge and understanding of fundamental computer networking concepts, protocols and architectures and aims to extend that knowledge in practice. Students will be able to gain a deeper understanding and appreciation in computer networks and the Internet by having hands-on experience with real networks and will learn how to configure and maintain network systems.

### **Software Development Tools And Methods**

This module introduces students to industry standard and current best practice tools and techniques used in the development of software systems. The Unified Modelling Language (UML) is used to produce models of the system at various stages in a software project, and to illustrate how these models can be elaborated from analysis through to design, implementation and deployment.

Patterns and frameworks that occur across a range of problems and applications are explored.

Alternative models of the process of software development are introduced.

This is a practical module with an emphasis on the use of suitable software tools.

### **Mobile Standards, Interfaces & Applications**

Mobile and pervasive computing is a rapidly evolving area and so the main body of knowledge will be taught through the close reading of the most up-to-date research in the area. Themes covered could include pervasive computing, mobile HCI, privacy and security, location and context awareness, technological transparency vs proactivity, mobile development platforms, networking and data standards. Ensuring deep and broad background in these ideas constitutes the seminar part of the course. Alongside this runs a practical course in programming for mobile devices based on one of the popular development platforms. Following this, students in groups create a substantial mobile application project involving the research, specification, design, implementation and evaluation of a system using

real mobile devices, or conversely an emulation of such a system should the technological hardware not be available for the system envisaged.

### **Multimedia Specification, Design & Production**

The Multimedia Specification Design and Production module is intended to develop an advanced understanding of the stages in the development of multimedia computer applications. This will include the analysis, design, implementation and evaluation of interactive multimedia software as well as the design and development of the component media used in such software. There is a large practical element to the module within which students will develop advanced skills in a multimedia programming tool and use this tool in conjunction with the theoretical principles gained on the course to develop an interactive multimedia computer application.

### **Human Computer Interaction Principles and Practice**

This module introduces students to the concepts, tools, techniques, standards and guidelines that are needed to evaluate and build interactive systems. Students will study systems in a variety of contemporary domains and will undertake practical evaluation and design projects.

### **Web Services**

The term web services is used to define a number of protocols and technologies used to implement a service oriented architecture. These standards are designed to support the notion of using standardised interfaces to allow communication, integration and co-ordination of information between applications distributed over and accessible through a decentralised network environment.

This module develops students' understanding of the fundamental architectures of web services and the protocols and standards that underpin them. The module provides only a brief introduction to the basic technologies and associated practical skills before moving on to focus on architectural issues and evaluation of different technologies and their developments. This will be done in the context of specific application and/or enterprises. Examples could include applications within e-commerce, information retrieval and knowledge management.

### **Advanced Database**

This module is primarily designed for students with existing knowledge and experience of database design and implementation, and an understanding of the underlying theory and practice. The aim of the module is to enhance the students' existing understanding and knowledge through focussed study of selected current and emerging issues in the database field. The study will be grounded in sound understanding of relevant theory, practice and principles and promote a practical understanding and critical awareness of the selected issues.

### **Measures & Models for Software Engineering**

In this module advanced issues of software engineering theory and practice are examined. The range of software engineering products and processes making up a software project are measured and modelled. Typical software engineering products explored in the module may include- user requirements, design documents, code etc. Typical software engineering processes explored in the module may include- testing, de-bugging etc. The aim of the module is to use the modelling and measuring of such products and processes to allow quantified decision-making during software development.

The module offers students the opportunity to explore both the state-of-the-art and the-state-of-the-practice in software engineering. The module will examine the most up to date research findings about software engineering as well as investigate the current practices of many software engineering companies.

### **Multicast and Multimedia Networking**

How can we cope with users and computers that move from place to place, and yet wish to remain in contact with the net? How do we deal efficiently with applications that have to send the same data to many different destinations? How can a network mix applications with very different quality of service requirements?

This module addresses these and other problems that must be solved if we are to integrate the gamut of diverse network applications onto a single network infrastructure. It exposes students to some of the most important developments in computer networking. By the end of the module, you will be familiar with most of the important issues and ideas in applying high-speed network technology to applications with diverse quality of service requirements.

### **Distributed Systems Security**

A range of topics will be covered in this module. The detailed content will vary according to current research directions. Case studies will be used throughout. Issues will be considered in relation to each topic as appropriate. These pervasive issues are- models, design, standards, protocols, and performance.

### **Neural Networks and Evolutionary Computation & Robotics**

A study of a selection of research topics centred around evolutionary neural networks, neural network design, machine learning and some interesting applications, for example, Data Mining, Biocomputation, Robotics, Evolutionary Algorithms, Neural Networks as models of human cognition, and data visualization. Actual topics taught may vary from year to year.

### **Software Engineering Practice and Experience**

This module gives students the opportunity to extend their understanding and experience of software engineering practice. It offers students exposure to the development and evolution of software. The module is very practical and is based around a substantial piece of software.

The aim of the module is to enable students to develop software engineering knowledge and skills that are transferable to software companies.

The module covers each element of the software engineering process. It explores the use of overarching development approaches such as eXtreme Programming and Component Based Software Engineering. Leading edge practices are introduced such as using program slicing to find code faults. Specialised software development approaches are investigated such as those required for application areas such as safety critical systems. Process models popular with industry, such as one of the SEI models, are also used and evaluated during this module.

### **Wireless, Mobile and Ad-hoc Networking**

This module provides how can students cope with users and computers that move from place to place, and yet wish to remain in contact with the net? This module looks at a range of wireless communications technologies, and addresses some of the problems of mobile ad-hoc and wireless networks. It exposes students to some of the most important developments in computer networking.