



Computer Science

Key information

Head of Department

Professor John McDermid OBE

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English language requirement

IELTS 6.5 or equivalent (see page 26) with a minimum of 6.0 in each component for taught programmes

IELTS 6.0 with a minimum of 5.5 in each component, or equivalent for research programmes

Programmes offered

MSc in Computing

MSc in Human-Centred Interactive Technologies

MSc in Information Technology

MSc in Natural Computation

MSc in Social Media and Interactive Technologies

MSc in Software Engineering

MRes in Computational Biology

MSc in Computer Science (by research)

MPhil/PhD

Engineering Doctorate in Large Scale Complex IT Systems

MSc/Diploma/Certificate in Gas Turbine Control

MSc/Diploma in Safety-Critical Systems Engineering

Postgraduate Certificate in System Safety Engineering

The Department of Computer Science at York is consistently ranked among the top computer science departments in the UK. Our excellence in teaching and research combined with our superb new facilities have helped us to gain a strong international reputation. We have a major influence in the development of the subject and on industrial practice.

We have the highest calibre of academic staff, with the majority being classed as ‘world-leading’ or ‘internationally excellent’ for original and significant work according to the 2008 Research Assessment Exercise. The Department’s teaching is equally highly regarded. The Department is consistently ranked among the top computer science departments in the UK.

Current research is funded by grants and contracts with a value totalling more than £6 million. Funding comes from the Engineering and Physical Sciences Research Council, the European Commission, other government departments and industry. The Department has excellent relations with industry including BAE Systems, QinetiQ and Rolls-Royce. Research activity centres on the Department’s nine major research groups: Advanced Computer Architectures; Artificial Intelligence; Computer Vision; Enterprise Systems; High-Integrity Systems Engineering; Human-Computer Interaction; Programming Languages and Systems; Non-Standard Computation; and Real-Time Systems. All of these groups are internationally recognised, and many are world-leading. Websites for each group, describing their research in detail, are accessible via the Department’s home page. We emphasise a multidisciplinary approach to research and there is significant collaboration with other departments at York and with researchers around the world in both universities and companies. This includes the York Centre for Complex Systems Analysis (YCCSA), a multidisciplinary centre studying complexity in both natural and man-made systems.

We drive our teaching by our research and the topics we teach are both fresh and forward looking. Our postgraduate taught programmes are developed in collaboration with industry and relevant professional bodies, ensuring our programmes remain dynamic and relevant.

The British Computer Society and the Institution of Engineering and Technology accredit our taught programmes to the maximum extent possible.

The Department boasts a warm and friendly environment which supports and develops research and learning. We are accommodated in a state-of-the-art, purpose-built building on the campus expansion at Heslington East. Departmental teaching and research are supported by cutting-edge equipment and facilities.

Research students choose to work with one of our research groups, enjoy all the facilities of the Department, are funded to attend conferences and experience a number of training opportunities in addition to their research studies. Postgraduate teaching includes core computing issues and advanced topics, and our programmes differ in emphasis to suit your particular interests and chosen career path. More details about the programmes, including individual modules, can be found at www.cs.york.ac.uk/postgraduate.

Career prospects

The Department has excellent relations with industry together with significant research grants and contracts from government departments, industry and the European Commission.

Programmes overview

We offer a thriving suite of full-time and part-time Masters programmes that build on the excellent research done within the Department. The programmes address the challenges faced by industry and academia to equip you for a career within the discipline.

All of our programmes are developed in collaboration with industry, and our Engineering Doctorate provides the opportunity to undertake industrial research within an organisation.

If you choose to undertake a degree by research (MSc/MPhil/PhD), you can work closely with any of our nine internationally respected research groups.

Available funding

For our taught programmes, a limited number of studentships are available. See our website for more details.

MSc in Computing

The MSc in Computing is a full-time one-year programme intended for those seeking to become experts in the IT industry. On graduation, you may enter employment as an expert programmer, technical consultant or software engineer, or progress to a doctoral programme.

The programme concentrates on the following areas:

- Programming: a thorough grounding in advanced programming concepts using Java, including algorithm design and in-depth understanding of real-time concurrent programming
- Testing: a methodological exposition of methods for systematic software performance measuring and testing
- User Interfaces: theory and practice of human-computer interaction (HCI)
- Formal Methods: practical and theoretical methods for verifying and specifying software using Z.

The programme comprises eight taught modules as well as an individual research project during the final six months.

Your background

Typically you will have achieved at least a 2:1 honours degree (or international equivalent) in Computing or an IT-related subject.

MSc in Human-Centred Interactive Technologies

This programme aims to provide you with a thorough grounding in the design and evaluation of interactive technologies of all kinds, from the perspective of people who use the systems. Its unique emphasis is on developing an understanding of users' capabilities and requirements, including

particular requirements of older or disabled users. You will learn a wide range of techniques to produce technologies best suited to the users and the sound theoretical and practical basis behind these techniques.

The MSc is a full-time one-year programme. There are eight taught modules and in the second half of the year, you will undertake a substantial individual project in any area of human-centred interactive technologies.

Graduates from this programme would be expected to go on to do commercial work in areas such as usability, user-centred design, web design, accessibility, human factors and user experience design, or academic research in these areas.

Your background

Typically, you will have achieved at least a 2:1 honours degree (or international equivalent) in a computing discipline. We will also consider applicants with appropriate work experience, such as experience in web design.

MSc in Information Technology

The MSc in Information Technology is a full-time one-year programme intended for students seeking a professional career in the IT industry but who do not necessarily have a background in computing. Graduates enter employment as computer programmers, technical consultants and media specialists as well as pursuing doctoral programmes.

The programme aims to:

- provide a broad education in applicable areas of information technology
- provide a specialised knowledge in programming, networks, operating systems, web design, databases and software engineering.

Taken together, the modules provide grounding in the technologies and practices essential in the IT industry.

The programme comprises taught modules followed by an individual research project.

Your background

Typically, you will have achieved at least a 2:1 honours degree (or international equivalent) in any discipline, as well as some computing or programming experience.

MSc in Natural Computation

The MSc in Natural Computation aims to provide you with a thorough grounding and practical experience in the use of advanced techniques of natural computation, by broadening ideas about computation to include ideas from mathematics, physics, electronics and biology. After completing the programme you will be equipped to play leading and professional roles in natural computation-related aspects of industry, commerce, academia and

public service. Where other programmes emphasise particular aspects of nature-inspired computation, or concentrate on the application of techniques in a particular domain, the emphasis of this programme is on developing the computational view of natural processes.

The MSc is a full-time one-year programme consisting of nine taught modules and an individual research project, under staff supervision. The taught modules are organised into three strands: Bio-inspired Computation (eg neural networks, evolutionary algorithms), Embodied Computation (eg quantum computation), and Complexity and Emergence (eg dynamical systems, emergent behaviour).

Your background

Typically, you will have achieved at least a 2:1 honours degree (or international equivalent) in Computer Science or a related discipline with an appropriate mathematical basis. If you do not have an appropriate Computer Science qualification but have compensatory experience, for example appropriate industrial experience, this will also be considered.

MSc in Social Media and Interactive Technologies

This programme is organised and taught jointly with the Department of Sociology, and is fully described on page 146.

MSc in Software Engineering

Software engineering is a crucial discipline in the functioning of the modern world. Information systems, communications, transport, manufacturing and services all require well-engineered, dependable software. The Software Engineering programme focuses on software systems with a high requirement for dependability. It aims to provide you with:

- a thorough grounding and practical experience in the use of state-of-the-art techniques for software systems development
- an understanding of the principles behind these techniques, to enable you to make sound judgements during the design and deployment of systems.

This is a full-time one-year taught programme. It comprises eight taught modules, a team project and an individual research project.

Your background

Typically, you will have achieved at least a 2:1 honours degree (or international equivalent) in Computer Science or a related discipline with an appropriate mathematical basis. Industrial experience is also useful.

MRes in Computational Biology

This programme is organised and taught jointly with the Departments of Biology and Chemistry, and is fully described under the entry for Biology on page 35.

MSc/MPhil/PhD research degrees

These are degrees by research: from the start, you will undertake a research project working closely with your selected supervisor. A second member of staff – an assessor – provides further support. You will be attached to one of the established research groups and so benefit from the accumulated knowledge and resources of your colleagues. You are encouraged to work in collaboration with others and to present your ideas at some of the many research seminars held regularly in the Department.

The Department has established a structured programme that includes a series of milestones carefully chosen to guide you towards the submission of a successful thesis. In the first year, research skills seminars are provided, and relevant advanced taught modules may be attended if necessary. Full-time MSc candidates are registered for one year, MPhil candidates for two years, and PhD candidates for three years. These periods are doubled if you attend part-time.

Your background

Typically you will have achieved at least a 2:1 honours degree, or equivalent. You are not required to have a Masters-level degree for direct entry to the PhD programme.

Available funding

The Department allocates 10 to 15 research studentships per year, awarded competitively; these fund tuition fees and living expenses, wholly or in part. Most of you will also act as teaching assistants for a small part of your time, for which you will be paid.

The Department also has funds to help you attend international conferences, and the William Gibbs award is made annually to a second year research student to fund an extended visit to an international research centre.

Engineering Doctorate in Large Scale Complex IT Systems

The Engineering Doctorate in Large Scale Complex IT Systems (LSCITS) is a full-time four-year doctoral-level training programme. Graduates of the programme are expected to find employment as researchers, research managers or in other senior positions. This innovative programme aims to significantly extend your abilities in the range of competencies required to address current and forthcoming challenges in the science

and engineering of large-scale complex IT systems. These include mathematical and formal methods, high-integrity systems and software engineering, and social-technical systems engineering.

The programme comprises a taught component involving technical and non-technical modules usually delivered in one-week blocks at the universities of Bristol, Oxford, St Andrews and York. There is also a research component involving students working closely with a sponsoring organisation on a research project leading to the submission of a doctoral thesis. The majority of this research project work will be undertaken at the sponsoring organisation.

Your background

Typically you will have achieved at least a 2:1 honours degree in Computer Science or a cognate discipline (eg Electrical Engineering, Physics, Chemistry), or have equivalent experience. You must also have a good knowledge of computer science, mathematics and programming, such as may be taught in undergraduate degree programmes in Computer Science.

Available funding

Engineering and Physical Sciences Research Council (EPSRC) studentships are available for home/EU candidates who meet the eligibility requirements. See www.cs.york.ac.uk/engd for more details.

MSc/Diploma/Certificate in Gas Turbine Control

MSc/Diploma in Safety-Critical Systems Engineering

Postgraduate Certificate in System Safety Engineering

These part-time programmes are built on research work at York supported by a number of industrial organisations,

including BAE Systems, Rolls-Royce and Aero Engine Controls.

The MSc in Gas Turbine Control provides students with a thorough understanding of issues in the design and assessment of embedded control systems used in the control of gas turbines. The programme embraces systems, software and safety engineering.

The Safety-Critical Systems Engineering (SCSE) programme emphasises the issues of developing and operating systems incorporating safety-critical software, while the Certificate in System Safety Engineering concentrates on safety issues in complex systems of all kinds.

These programmes aim to enable you to take a leading role in the design, assessment and support in operation of systems with high safety impact.

These modular programmes are designed for part-time students to be taken over three or four years; the SCSE programme may also be taken over one, two or three years.

These programmes consist of a number of core and optional modules, each taught over a one-week period. Programme areas covered include systems and safety engineering; operational safety; control theory and architecture; electrical and electronic systems design; software implementation and testing; and safety case and safety management systems. The full MSc programmes include a supervised project (taken in two parts) in a related subject area and are partially accredited for Chartered Engineer status.

Your background

These programmes are specifically directed at those with several years of industrial experience. An appropriate degree is desirable, but many applicants will have reached degree-level knowledge through their work experience. The Gas Turbine Control programme assumes some knowledge of gas turbine design and operation; anyone without such background knowledge should consult with the Department before applying.

“The PhD in Computer Science offers in-depth exploration of many scientific theories, technologies and applications. The most interesting aspect of the programme has been learning about the minute details that might help me to contribute to the future of these technologies. I’ve enjoyed presenting my work at international conferences, and meeting pioneers in the field of Computer Science. The Department and staff offer valuable support in administrative, technical and educational issues.”

Rania, PhD in Computer Science



Staff list

Professor and Head of Department

John McDermid OBE, FREng, PhD (Birmingham) Safety engineering; security; safety-critical software; large-scale software engineering

Professors

James Austin, PhD (Brunel) Neural networks; e-science and grids; parallel computation; neuroscience-inspired computation
Samuel Braunstein, PhD (Caltech), CPhys, FInstP Quantum computation; small-scale machine design
Alan Burns, DPhil (York), CEng, FBCS, FIET Real-time systems; resources scheduling; real-time programming languages
John Clark, DPhil (York) Security; cryptography; non-standard computation; software engineering
Edwin Hancock, PhD, DSc (Durham) Computer vision; pattern recognition; machine learning; brain imaging; graph theory
Richard Paige, PhD (Toronto) Model-driven development; software engineering; formal methods; software architectures; security
Helen Petrie, PhD (London) Human-computer interaction; disabled and older users; psychological aspects of technology use
Colin Runciman, DPhil (York) Programming languages and systems; functional programming
Susan Stepney, PhD (Cambridge), CEng, FBCS Bio-inspired algorithms; complex adaptive systems; emergent properties; nanite assemblers
Jonathan Timmis, PhD (Wales) Artificial immune systems; immune modelling; complexity; embedded systems
Andy Wellings, DPhil (York) Real-time programming languages and operating systems
Richard Wilson, DPhil (York) Inexact graph matching; structural pattern recognition; stereo and shape-from-shading
Jim Woodcock, PhD (Liverpool), FBCS, CITP Grand challenge in verified software; dependable software engineering; formal methods

Readers

Ana Cavalcanti, DPhil (Oxford) Program verification; concurrency; object-orientation; control systems; formal methods; Z; CSP
Alan Frisch, PhD (Rochester) Artificial intelligence; constraint programming; automated generation of constraint programs

Senior Lecturers

Neil Audsley, DPhil (York) Embedded real-time system implementation: architectures, programming, operating systems, analysis
Iain Bate, DPhil (York) Real-time and critical systems design and analysis; search-based engineering
Paul Cairns, DPhil (Oxford) Statistical modelling of users; video games and immersion; human-computer interaction
James Cussens, PhD (London) Machine learning; graphical models; statistical relational learning; inductive logic programming
Alistair Edwards, PhD (Open) Novel forms of multi-modal human-computer interaction
Dimitar Kazakov, PhD (Prague) Artificial intelligence; machine learning; adaptive agents; computational linguistics; language origins
Tim Kelly, DPhil (York) Development, modelling, analysis and certification of high-integrity systems
Steve King, DPhil (Oxford) Formal software development; refinement; provably-correct software; safety-critical software
Manuel Oriol, PhD (Geneva) Dynamic updates; software testing; computer science education; middleware
Nick Pears, PhD (Durham) Computer vision and pattern recognition in biometrics, robotics and HCI
Detlef Plump, Dipl.-Inform., Dr.-Ing., Habilitation (Bremen) Graph transformation; graph-based programming models; rewriting systems; theoretical computer science
Fiona Polack, PhD (Cambridge) Practical systems engineering: formal, nonclassical, model driven; dependability argumentation
Alan Wood, PhD (London) Distributed computing; radical programming languages and models; co-ordination systems and languages

Lecturers

Rob Alexander, PhD (York) Autonomous systems; systems of systems; safety engineering; simulation
Chris Bailey, PhD (Teesside) Novel processors and arrays; code optimisation and translation; VLSI design
Ian Benest, PhD (Essex) Hypermedia interfaces for everyone, especially for teaching and learning
Adrian Bors, PhD (Thessaloniki) Computer vision; image processing; pattern recognition; computational intelligence
Jeremy Jacob, DPhil (Oxford) Mathematical modelling of systems, properties and languages
Dimitrios Kolovos, PhD (York) Model-driven engineering; object-oriented design; software architecture; programming languages
Daniel Kudenko, PhD (Rutgers) Artificial intelligence: games and interactive entertainment, machine learning, user modelling
Suresh Manandhar, PhD (Edinburgh) Natural language processing; minimally supervised learning of syntax and semantics
Simon O'Keefe, DPhil (York) Neural network; binary correlation matrix memory; non-standard and natural computation
Stefano Pirandola, PhD (Camerino, Italy) Quantum information and computation; quantum cryptography
Christopher Power, PhD (Western Ontario) Human-computer interaction; accessibility; user requirements; evaluation methodologies
William Smith, PhD (York) Face recognition; shape-from-shading; reflectance/appearance modelling; multispectral imaging
Leandro Soares Indrusiak, Dr.-Ing. (TU Darmstadt, UFRGS) Design and verification of embedded systems: multi-processor, distributed, real-time, reconfigurable

Research and Teaching Fellows

Rob Davis, DPhil (York) Real-time systems; scheduling analysis; industrial applications
Dan Franks, PhD (Leeds) Network theory and analysis; complex systems; agent-based modelling; bio-inspired computing
Mike Freeman, PhD (York) Hardware architecture for high speed text and vector processing
Ibrahim Habli, PhD (York) Software architectures; product-line development; software safety; safety cases
Matthew Naylor, PhD (York) Programming languages; functional programming; computer architecture
Mark Nicholson, DPhil (York) System safety engineering; safety-critical software; statistical analysis; reconfiguration
David Pumfrey, DPhil (York) Hazard identification; risk assessment; system and software safety analysis
Andrew Rae, PhD (Queensland) Safety engineering; software safety; safety risk acceptability
Tommy Yuan, PhD (LeedsMet) Human-computer dialogue; software agents and their communications; dialogue game theory