

UNIVERSITY OF  
**EXETER**

# COMPUTER SCIENCE

UNDERGRADUATE SUBJECT BROCHURE 2018



# KEY INFORMATION AND ENTRY REQUIREMENTS

	UCAS CODE	TYPICAL OFFER
<b>Single Honours</b>		
MSci Computer Science	I402	AAA-ABB; IB: 36-32
MSci Computer Science and Mathematics	GG4D	A*AA-ABB; IB: 38-32
BSc Computer Science	I400	AAA-ABB; IB: 36-32
BSc Computer Science with Industrial Placement	I401	AAA-ABB; IB: 36-32
BSc Computer Science and Mathematics	GG4I	A*AA-ABB; IB: 38-32
BSc Computer Science and Mathematics with Industrial Placement	GG4C	A*AA-ABB; IB: 38-32
BSc Digital and Technology Solutions (Degree Apprenticeship)	N/A*	AAB; IB: 34; BTEC Level 3 Extended Diploma DDD
<b>BA/BSc Flexible Combined Honours</b>		
Flexible Combined Honours/with Study Abroad*/with UK Work Experience/with Work Abroad	Y004/Y006/ Y007/Y008	A*AA-AAB; IB: 38-34

\*BSc Digital and Technology Solutions does not follow the standard UCAS application process. To gain a place you must apply directly to one of our partner employers' vacancies. You can apply to this programme in addition to making applications to any institution through UCAS.

The full and most up-to-date information about Computer Science is on the undergraduate website at [www.exeter.ac.uk/ug/computer-science](http://www.exeter.ac.uk/ug/computer-science) and we strongly advise that you check this before attending an Open Day or making your application. Some programmes require prior study of specific subjects and may also have minimum grade requirements at GCSE or equivalent, particularly in English Language and/or Mathematics.

We make every effort to ensure that the entry requirements are as up-to-date as possible in our printed literature. However, since this is printed well in advance of the start of the admissions cycle, in some cases our entry requirements and offers will change.

## International students

If you are an international student you should consult our general and subject-specific entry requirements information, for A levels and the International Baccalaureate, but the University also recognises a wide range of international qualifications. You can find further information about academic and English language entry requirements at [www.exeter.ac.uk/ug/international](http://www.exeter.ac.uk/ug/international)



The Athena SWAN Charter recognises and celebrates good employment practice for women working in Science, Technology, Engineering, Mathematics and Medicine (STEMM) in higher education and research. We believe it is vitally important that women are adequately represented in what has traditionally been a male-dominated area, as we strive for equality. The University is proud to have held a Bronze institutional award since 2011, and we were awarded a Bronze award at departmental level in 2014. In 2016 the Computer Science and Mathematics departments achieved a Silver Athena SWAN award. Find out more at [www.exeter.ac.uk/computer-science/about/swan](http://www.exeter.ac.uk/computer-science/about/swan)

For information on the application, decision, offer and confirmation process, please visit [www.exeter.ac.uk/ug/applications](http://www.exeter.ac.uk/ug/applications)

## STREATHAM CAMPUS, EXETER

Website: [www.exeter.ac.uk/ug/computer-science](http://www.exeter.ac.uk/ug/computer-science)

Email: [compsci@exeter.ac.uk](mailto:compsci@exeter.ac.uk)

Phone: +44 (0)1392 724061

# COMPUTER SCIENCE

88% of Computer Science students in graduate level employment or further study within six months of graduating<sup>1</sup>

76% of research classified as world-leading or internationally excellent<sup>2</sup>

11th in *The Complete University Guide 2017*

£3 million invested in new academic and student facilities

Industrial placements available as part of all programmes

There has never been a greater need for experts in computer science. From the complex IT systems used in modern businesses to sophisticated online gaming platforms and smartphones, tablets and other mobile devices; computers are a familiar characteristic of the modern world. This makes for a fascinating range of careers that require the technical expertise of a computer scientist, as someone who understands the science behind computer technology.

As a graduate you may find yourself working with business IT systems, the web, mobile app development, games technology, the data analytics that are used to underpin modern science and business, or in the development of safety-critical systems that control aeroplanes, trains and power stations. Alternatively you may find yourself starting your own technology business as some of our entrepreneurial graduates have done.

During your time with us you'll develop your problem-solving skills, your technical competence and your ability to analyse and reflect on issues relating to computer technology. These are essential skills whether you wish to work for a leading computing company developing new technologies, enter the world of business and finance, or if you would like to use your degree in a different role where you can make the most of your analytical and problem-solving ability.

We maintain excellent teaching links with computer-related industries via business-linked projects, whilst organisations such as The Met Office, NATS, IBM and Huawei Technologies also collaborate in research and student project work. The Met Office, for example, offer a joint employability scholarship to enable two top performing students to gain experience in the IT sector.

In addition to our core Computer Science degree, we offer Computer Science degrees with Mathematics, which have a greater scientific focus. All our programmes include the opportunity to gain practical experience in industry, either through an eight to 12 week summer placement or by taking a year in industry.

<sup>1</sup> Destination of Leavers from Higher Education Survey (DLHE) of 2014/2015 undergraduates

<sup>2</sup> Research Excellence Framework 2014 based on the percentage of research categorised as 4\* and 3\*



# DEGREE PROGRAMMES

Our interdisciplinary programmes cover a range of skills within computer science from programming, basic science, discrete mathematics and logic, through to the latest developments in knowledge representation, pattern recognition, artificial intelligence and evolutionary computing. We have a strong emphasis on the application of computer science to solving practical scientific, technological and business problems. Teaching relates directly to our active interdisciplinary research expertise, bringing the most up-to-date ideas and innovations into your degree programme.

We explore the fundamental aspects of system design; software development and deployment; multimedia systems incorporating graphics, animation and video; and the role of the internet. New techniques, including genetic algorithms and neural networks, are central to our teaching, as are approaches to dealing with the modern phenomenon of 'big data', through improved algorithms and architectures for data mining and processing.

You will not only develop a technical understanding of computing theory, software and hardware, but also enhance your ability to think clearly and logically, and ultimately getting to the heart of a complex problem. Because of this, our graduates are highly regarded by prospective employers in a variety of sectors.

## How your degree is structured

The University operates a credit system, with each year's work comprising of modules worth 120 credits. The majority of modules in Computer Science are 15 credits, so typically you would take eight modules in a year.

In the first and second years of each programme there are a number of compulsory modules which provide a thorough grounding in essential core topics. Full programme structures and module details can be found towards the back of this brochure.

For up-to-date details of all our programmes and modules, please check [www.exeter.ac.uk/ug/computer-science](http://www.exeter.ac.uk/ug/computer-science)

## Single Honours

### MSci/BSc Computer Science

This programme explores more than simply how computers and software work. Focus on the wider context within which the subject must operate; from the precise technical details to their application in social, scientific and industrial contexts. By combining logical thinking with key mathematical skills, our Computer Science degree prepares our graduates to pursue prosperous careers in a variety of sectors.

You will develop practical skills in the specification, design and implementation of computer systems, as well as a solid understanding of the theory behind them. Our world-class teaching is informed by research of international standing in developing fields including machine learning and artificial intelligence, nature-inspired computation, knowledge representation and reasoning, and high-performance computing.

You will be inspired and immersed in research-related topics throughout your degree through research-led modules such as *Artificial Intelligence and Applications*; *Outside the Box: Computer Science Research and Applications*; *Learning from Data and Nature-Inspired Computation*. Through these modules you will develop a strong appreciation for the 'science' in Computer Science.

As an undergraduate you will tackle new and emerging application areas such as mobile and ubiquitous computing, bioinformatics and systems biology and enterprise computing. You will learn new languages and technologies, and consider how they may be usefully applied and potentially improved upon.

**Year 1** This year provides you with a solid foundation in computer science. It includes an introduction to procedural and object-oriented programming, system architectures, computing for the web, professional issues of computing. Modules on computational mathematics and discrete mathematics for computer science provide the mathematical underpinning of later modules in computer science and artificial intelligence.

**Year 2** The second year includes exposure to rigorous software development and software engineering, together with information systems and computer security. Research-

led modules in artificial intelligence and computer science research across science and industry give the distinctive flavour of this degree. Optional modules span across a variety of topics, including algorithms, graphics, networks, mobile computing and C programming.

You can take our *Commercial and Industrial Experience* module as a summer work placement between your second and third years. The four-year BSc programme includes a year-long, paid placement with a relevant company during your third year, working on a substantial project and gaining first-hand experience of the practical application of computer science in business, industry and society.

**Year 3 (Year 4 for Industrial Placement students)** You will work on a substantial software development project, designed for application in the scientific and/or business community. This forms the core of your studies during this year, and allows you to develop your skills and interests in computer science. Partnered with a wide range of optional modules you have the flexibility to tailor your degree toward your specific interests. Students on the MSci may also take a term abroad in one of our international partner universities in their third year.

**Year 4 (MSci only)** This year includes advanced Masters level modules such as *Machine Learning*; *Computer Vision*; *Computer Modelling and Simulation*; *Evolutionary Computation and Optimisation* and a significant individual supervised project, typically in the field of applied artificial intelligence.



BSc Computer Science, both with and without industrial placement, is accredited by the BCS (The Chartered Institute of IT) in CITP (Chartered IT Professional), and holds partial CSci (Chartered Scientist) accreditation, awarded by the BCS on behalf of the Science Council. Accredited degrees provide a solid foundation for those seeking full Chartered IT professional and/or Scientist status.

## MSci/BSc Computer Science and Mathematics

Computer science and mathematics are beneficially intertwined, from the fundamentals of logic and computation embodied in the Turing machine and the mathematics of encryption used to secure transactions over the internet, to the use of computers in solving the equations governing climate change and the proof of theorems by computer algebra. Mathematics underpins computer science and computer science opens up new areas of mathematics. This synergistic interplay makes a degree in Computer Science and Mathematics a natural and complementing combination.

These degree programmes are designed for students with an interest in both fields. They are taught by both mathematicians and computer scientists, with an equal split of modules between the two disciplines initially, and up to 75 per cent computer science in later years.

The BSc programme is also available as a four-year variant including a year's paid industrial placement in your third year, working on a substantial project and gaining first hand experience of the practical application of computer science and mathematics.

The four-year MSci programme is a natural extension to the BSc Computer Science and Mathematics programme and offers an integrated Masters qualification for students wishing to combine these subjects at a higher level.

**Year 1** This year gives you a solid foundation in both computer science and mathematics and includes an introduction to procedural and object-oriented programming and system architectures. Alongside these you will take modules that will explore the underpinning mathematics for computer science through vectors and matrices,

calculus and geometry, advanced calculus and numbers, symmetries and groups.

**Year 2** The second year includes exposure to rigorous software development and software engineering best practice. You will also cover the development, use and properties of computer languages and be exposed to some of the frontiers of computer science research. Additionally in mathematics you will cover vector calculus and differential equations, alongside a range of options.

**Year 3** You will undertake a project in which you will develop a substantial software system for scientific and/or business purposes and take a wide range of optional modules. This allows you to tailor your degree toward your specific interests.

**Year 4 (MSci only)** This year includes advanced Masters-level modules in both disciplines such as *Machine Learning*; *Computer Modelling and Simulation*; *Mathematical Analysis of Biological Systems*; *Modelling the Weather and Climate*; *Dynamical Systems and Chaos*; and a significant individual supervised project.

## Flexible Combined Honours

This innovative Combined Honours scheme enables you to combine modules from a number of different fields of study not otherwise available through an existing Combined Honours programme. You can combine Computer Science with up to two other subjects from an extensive list. Throughout your degree you will be given regular support to help you choose the most appropriate pathway for you. Further information and the full list of available subjects can be found at [www.exeter.ac.uk/ug/flexible](http://www.exeter.ac.uk/ug/flexible)

## Degree apprenticeship

### BSc Digital and Technology Solutions

Degree apprenticeships are a government-funded way for students to gain a degree whilst working full time. Students will earn a salary and gain extensive professional experience throughout their degree, have access to all aspects of the 'Exeter experience' such as the Students' Guild advice and careers services and will graduate into employment, most likely with the apprenticeship employer.

The BSc Digital and Technology Solutions degree apprenticeship is taught via blended learning over four or five years, and students will study predominantly through e-learning and residentials, focusing on work-based projects. Five role-specific specialist pathways are available: Software Engineer, Data Analyst, IT Business Analyst, IT Consultant and Cyber Security Analyst.

**Year 1 (compulsory)**  
Business Organisation  
Interpersonal and Foundation Skills  
Information and Data  
System Development 1  
Reflective Practice 1

**Year 2 (compulsory)**  
Digital Technology Infrastructure  
Information Security  
IT Project Management  
Systems Development 2  
Reflective Practice 2

**Year 3 (compulsory)**  
Information Systems  
Reflective Practice 3  
IT Law and Ethics

**Year 4 (compulsory)**  
Synoptic Project

For more information visit [www.exeter.ac.uk/degreeapprenticeships](http://www.exeter.ac.uk/degreeapprenticeships)

 The lecturers come from different countries and backgrounds, which is interesting in terms of the learning experience as you get a different approach from each of them. They are always ready to help and you get to know them really quickly because of the small class sizes. There is also a strong academic mood that I particularly enjoy. When you realise that you're surrounded by the country's leading academics that definitely inspires you to work smarter and harder. 

Kate Moksina, BSc Computer Science and Mathematics



# LEARNING AND TEACHING

We encourage a supportive environment where students and staff work together in an informal and friendly atmosphere. The department has a student-focused approach to teaching, whereby all members of staff deal with questions on an individual basis. We operate an open door policy, so it is easy to consult individual members of staff or to fix appointments with them via email. As a friendly group of staff, you will get to know us well during your time here.

Alongside your academic studies you will develop personal skills, gaining expertise in communications, team work and project management, plus the ability to debate and reflect on the effects of new developments within society and individual lifestyles. The aim is to teach a science-rich syllabus that you will find intellectually challenging, rewarding and exciting, encompassing a balance of theory and practical application.

We make use of a variety of teaching styles, including lectures, seminars, workshops and tutorials. Most modules involve two or three lectures per week, so you will typically have about 10 lectures each week. In addition, workshops and tutorials support and develop what you've learnt in lectures and enable you to discuss the lecture material and coursework in more detail. You'll have over 15 hours of direct contact time per week with your tutors and you will be expected to supplement your lectures with independent study. You should expect your total workload to average about 40 hours per week during term time.

Working through examples, solving problems and developing programming skills are a vital part of learning computer science, so coursework forms a component of all modules. All modules have a reading list consisting of chapters from textbooks and research articles from journals.

We're actively engaged in introducing new methods of learning and teaching, including frequent use of interactive computer-based approaches to learning through our virtual

learning environment, where the details of all modules are stored in an easily navigable website. You can access detailed information about modules and learning outcomes and interact with others through activities such as discussion forums.

## Facilities

We have benefited from a £3 million investment in academic and social facilities including completely refitted lecture theatres and teaching spaces, a major expansion and upgrading of our undergraduate computer facilities, including our new Apple Mac laboratory and social space.

We have a range of purpose-built computer rooms and lecture facilities fitted with the latest audio-visual equipment. There is an ongoing programme of investment in new computers and software. The computers used for undergraduate teaching include a range of machines running either Windows, Mac OS or Linux. On these computers you can access specialist software, work on programming languages such as Java and Python, undertake multimedia work or simply access the network for email or internet browsing. In addition there are specialised computing facilities within the department, such as clusters that support high-performance computer intensive research.

## Taking modules outside of your programme

Depending on your programme you may take up to 30 credits in another subject (subject to academic approval and timetabling), for instance a language or business module, to develop career-related skills or widen your intellectual horizons. If you achieve at least 60 credits in a language via our Foreign Language Centre you may be able to have the words 'with proficiency in' and the language added to your degree title. Further details about the FLC can be found at [www.exeter.ac.uk/flc](http://www.exeter.ac.uk/flc)

## Research-inspired teaching

All our academic staff are engaged in internationally recognised scientific research across a wide range of topics including: artificial intelligence and information engineering; multi-objective optimisation; machine learning; genetic algorithms; statistical analysis of gene expression; knowledge representation; advanced technologies for data mining; pattern recognition; high-performance computing and distributed systems; software engineering; safety-critical software design; bioinformatics and hydroinformatics. Where possible, we incorporate findings from this research into teaching, particularly within modules such as *Artificial Intelligence and Applications*, and *Outside the Box: Computer Science Research and Applications*.

# CAREERS

Career opportunities for computer scientists are plentiful and varied. Our graduates can be found working in the private and public sector in areas such as software engineering, health, communications, education, life sciences, physical sciences, finance and manufacturing. Computer scientists from Exeter have a reputation as being articulate, numerate problem solvers, who typically claim great job satisfaction, a good salary and a huge range of career possibilities.

Exeter has an excellent reputation with graduate recruiters and a strong employment record. Major employers target Exeter graduates irrespective of their degree subject. We offer a very wide range of opportunities for students to obtain work experience and develop the skills employers are looking for.

Many students from the department take part in the Exeter Award and the Exeter Leaders Award. These schemes encourage you to participate in employability related workshops, skills events, volunteering and employment which will contribute to your career decision-making skills and success in the employment market.

We also have opportunities for further study and there is a fast track application process for Exeter students to our Masters programmes.

For further information about what the careers service at Exeter offers, please visit [www.exeter.ac.uk/ug/careers](http://www.exeter.ac.uk/ug/careers)

## Examples of the destinations of our recent graduates:

### Employers

Apple // BAE // IBM // JP Morgan // Met Office // Microsoft // NHS // Proctor and Gamble // QinetiQ // RBS // Toshiba

### Occupations

Software Analyst // Resource Analyst // Trainee Stockbroker // Recruitment Consultant // IT Consultant // Software Developer // IT Data Tester // Web Developer // IT Manager // Transport Planner // Technology Services Graduate

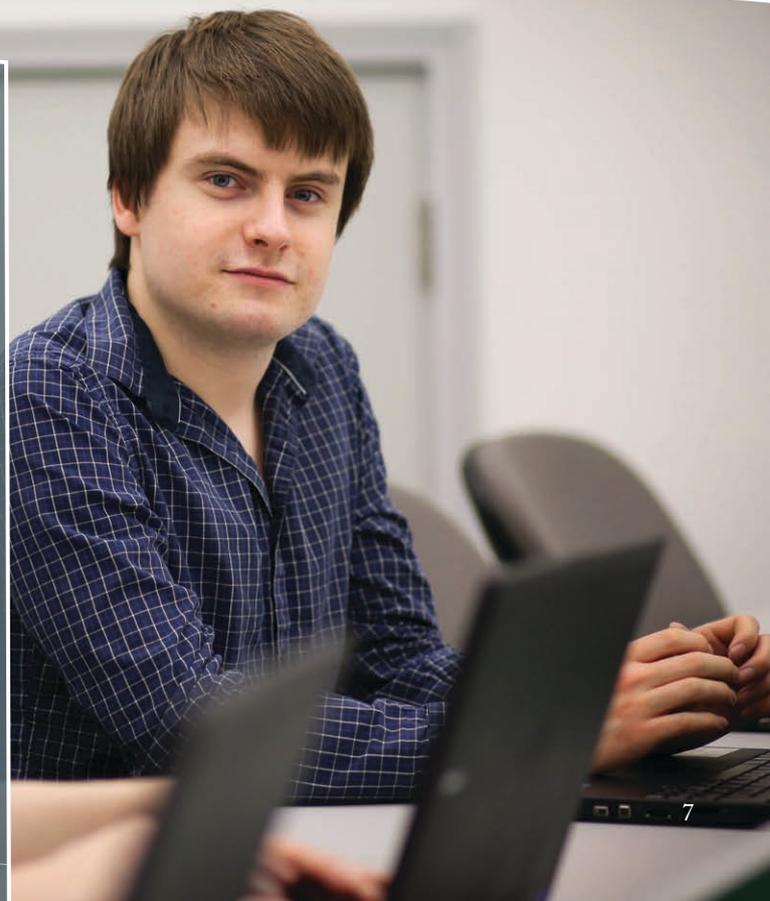
A number of our Computer Science graduates choose to go on to further study, with many choosing to continue their studies with us. A variety of subjects are studied from Masters level and PhDs in Computer Science and associated topics through to professional qualifications such as teaching.

## Examples of further study followed by our graduates:

- Applied Artificial Intelligence
- Robotics
- Environmental Economics
- Mathematical Modelling
- Computational Science
- PGCE Primary
- Astrophysics
- Graduate Diploma in Law
- Physics

 Having the chance to be a student representative for my course as part of the Student-Staff Liaison Committee has been a great addition to my studies. I've been able to take an active role in helping to shape the course and improve how it is run. I think it's really important that our views are represented, and the College of Engineering, Maths and Physical Sciences provides an excellent opportunity for the students to voice their opinions. 

Max Smart, MSci Computer Science and Mathematics



# MODULES

KEY C = Core  
● = Optional

For up-to-date details of all our programmes and modules, please check [www.exeter.ac.uk/ug/computer-science](http://www.exeter.ac.uk/ug/computer-science)  
Please note that availability of all modules is subject to timetabling constraints and that not all modules are available every year.

## Year 1 Modules

Module Name	MSci/BSc Computer Science	MSci/BSc Computer Science and Mathematics	BSc Digital and Technology Solutions
Advanced Calculus		C	
Business Organisation			C
Calculus and Geometry		C	
Computational Mathematics	C		
Computers and the Internet	C	C	
Data Structures and Algorithms	C	●	
Discrete Mathematics for Computer Science	C		
Information and Data			C
Interpersonal and Foundation Skills			C
Numbers, Symmetries and Groups		C	
Object-Oriented Programming	C	C	
Programming	C	C	
Reflective Practice I			C
Social and Professional Issues of the Information Age	C		
System Development I			C
Vectors and Matrices		C	
Web Development	C	●	

## Year 2 Modules

Module Name	MSci/BSc Computer Science	MSci/BSc Computer Science and Mathematics	BSc Digital and Technology Solutions
Artificial Intelligence and Applications	●	●	
Computer Languages and Representations	C	C	
Database Theory and Design	C	●	
Differential Equations		C	
Digital Technology Infrastructure			C
Information Security			C
IT Project Management			C
Mathematics Modules		●	
Mobile and Ubiquitous Computing	●	●	
Network and Computer Security	C	●	
Numerics and Optimisation		●	
Outside the Box: Computer Science Research and Applications	●	●	
Programming for the Web	●	●	
Reflective Practice 2			C
Software Development	C	C	
Software Engineering	C	C	
Statistics		●	
Statistical Modelling		●	
Systems Development 2			C
Systems, Series and Transforms		●	
The C Family – The History and Applications of C, Objective C, C++ and C#	●	●	
Vector Calculus and Applications		C	

### Year 3 Modules (Year 4 for Industrial Placement students)

Module Name	MSci/BSc Computer Science	MSci/BSc Computer Science and Mathematics	BSc Digital and Technology Solutions
Advanced Statistical Modelling		●	
Algorithms that Changed the World	●	●	
Bioinformatics and Systems Biology	●	●	
Commercial and Industrial Experience	●	●	
Computability and Complexity	●	●	
Computer Graphics	●	●	
Enterprise Computing	●	●	
Fluid Dynamics		●	
Graphs, Networks and Algorithms		●	
High-Performance Computing and Distributed Systems	●	●	
Individual Literature Review and Project	C	C	
Information Systems			C
IT Law and Ethics			C
Learning from Data	●	●	
Mathematical Biology and Ecology		●	
Nature-Inspired Computation	●	●	
Partial Differential Equations		●	
Reflective Practice 3			C
Statistical Inference		●	
Stochastic Processes		●	

### Year 4 Modules

Module Name	MSci Computer Science	MSci Computer Science and Mathematics	BSc Digital and Technology Solutions
ITMB Case Studies	●		
Computer Modelling and Simulation	●	●	
Computer Vision	●	●	
Dynamical Systems and Chaos		●	
Dynamics and Evolution of Biological Systems		●	
Evolutionary Computation and Optimisation	●	●	
Logic and Philosophy of Mathematics	●		
Logic, Ontology, and Knowledge Representation	●		
Machine Learning	●	●	
Mathematical Analysis of Biological Systems		●	
Mathematics Modules		●	
Modelling the Weather and Climate		●	
Nature-Inspired Computation	●	●	
Research Project	C	C	
Synoptic Project			C
The Climate System		●	



# MODULES CONTINUED

Please see below for a selection of module descriptions. For more information about modules across all our programmes please visit [www.exeter.ac.uk/ug/computer-science](http://www.exeter.ac.uk/ug/computer-science)

## Year 1

### Advanced Calculus

An introduction to advanced methods of calculus, building on knowledge acquired to develop further key ideas and skills that will form the necessary background for later study. The main emphasis of the module will be on practical methods and problem-solving; however, all results will be stated formally and each sub-topic will be reviewed from a mathematically rigorous standpoint.

### Computers and the Internet

Computers and the internet are now an integral part of everyday business and social life. This module will equip you with the foundational skills and knowledge necessary to understand and work with computers and networking technologies. This includes the ability to use an extensive range of hardware and software for industrial and business applications as well as the ability to analyse, design and develop web-based applications from informal specifications.

### Discrete Mathematics for Computer Science

This module provides you with the basic concepts and tools developed in discrete mathematics disciplines but needed for the study of computer science. As such, it forms an essential part of a rounded education of a computer scientist or computer expert whose work includes computer-based data manipulations.

### Object-Oriented Programming

Understand the object-oriented programming paradigm, now widely used throughout industry and science. Using the Unified Modelling Language (UML) and the Java programming language, the module introduces you to object-oriented problem-solving methods and provides object-oriented techniques for the analysis, design and implementation of solutions.

### Programming

Being able to program well is essential to computer science. This module introduces you to the procedural programming paradigm, and develops your problem-solving and analytical skills. It introduces you to the algorithmic formulation of solutions to problems, and will expose you to some of the scientific applications of programming.

## Year 2

### Database Theory and Design

Databases are an integral component of all industrial and commercial information systems. This module equips you with the theoretical and hands-on practical knowledge needed to design, develop and manage database systems using modern database management systems.

### Differential Equations

Develop an understanding of, and competence in, a range of analytical tools for posing and solving differential equations, specifically as applied to engineering situations. Learn the basic principles of differential equations, and apply that knowledge to some every day phenomena, as well as be introduced to calculation methods and computer models for general applications.

### Outside the Box: Computer Science Research and Applications

Go beyond the core technical content of the main syllabus, and understand the application of Computer Science in modern problem-solving and current research. Explore the frontiers of research within the field, and through specialist lectures, recognise some of the uses of computer science methods within the world of science, business, social sciences and humanities.

### Software Development

Extend your skills in object-oriented programming and introduces you to various software development methodologies and tools used in industry, including testing frameworks, version control and automated builds.

### Software Engineering

Delve into the aspects of software engineering that relate to the requirements analysis and production of large systems by the application of object-orientated programming techniques to a large and complex project in a team-working environment. The main objectives of this module are to introduce key aspects of software engineering to you in a practical way. Aspects of software engineering that will be covered in this module include the application of object-orientated programming techniques to large scale software system development, requirements analysis, human computer interface (HCI) design, software system design and development, software system testing and software system integration and deployment.

# MODULES CONTINUED

## Year 3

### Enterprise Computing

An introduction to the techniques used to implement large-scale distributed information systems. You will consider important interoperability issues for business to business (B2B) communications including Service Oriented Architecture and the semantic web.

### Fluid Dynamics

Develop a further understanding of the basic concepts of fluid dynamics associated with the flow of incompressible (constant density) fluids with both viscosity and inertia. You will learn to translate a physical problem into an appropriate mathematical system.

### Nature-Inspired Computation

There are a wide range of tasks, including product design, decision-making, logistics and scheduling, pattern recognition and problem-solving, which traditional computation finds either difficult or impossible to perform. However, nature has proven to be highly adept at solving problems, making it possible to take inspiration from these methods and to create computing techniques based on natural systems. This module will provide you with the knowledge to create and apply techniques based on evolution, the intelligence of swarms of insects and flocks of animals, and the way the human brain is thought to process information.

### Learning from Data

This module will introduce you to machine learning methods for learning from data. You will learn about the principal learning paradigms from a theoretical point of view and gain practical experience through a series of workshops. Throughout the module, there will be an emphasis on dealing with real data, and you will use, modify and write software to implement learning algorithms. It is often useful to be able to visualise data and you will gain experience of methods of reducing the dimension of large datasets to facilitate visualisation and understanding.

## Year 4

### Dynamical Systems and Chaos

Gain an excellent understanding of asymptotic behaviour of nonlinear dynamics and exposes you to qualitative and quantitative methods for dynamical systems, including nonlinear ordinary differential equations, maps and chaos.

### Evolutionary Computation and Optimisation

Evolutionary computation is the study of computational systems that use ideas and derive their inspiration from natural evolution. Its techniques can be applied to optimisation, learning and design. The main focus of this module is on optimisation problems. Example topics covered in this module include natural and artificial evolution, chromosome representations and search operators for continuous and combinatorial optimisation, co-evolution, techniques for constrained optimisation, multi-objective optimisation, dynamic optimisation, evolution of neural networks.

### Machine Learning

Develop a comprehensive grounding in the theoretical and practical aspects of machine learning as well as examining some of the philosophical and historical foundations of machine learning, including the limitations of what may be learned.

### Research Project

Explore substantial research projects, particularly in the field of applied artificial intelligence, and it aims to put into practice the knowledge acquired from the taught elements of the programme. It will give you experience of many aspects of research work including planning, experimentation and analysis, interpretation of results and presentation.

### Logic, Ontology, and Knowledge Representation

An important goal of artificial intelligence is to explore ways of endowing machines with the knowledge and reasoning capacities to enable them to behave in ways which we might recognise as intelligent. Of particular concern is the drive to emulate human 'common-sense' understanding, which requires us to answer such questions as: how do we describe and classify the elements that make up our common-sense knowledge of the world? This module introduces you to some of the main bodies of theory which have been employed to help answer such questions in the context of modern computer technology.



# ABOUT THE UNIVERSITY OF EXETER

Top 1% of universities worldwide (*Times Higher Education*)

9th in *The Times* and *The Sunday Times Good University Guide 2017*

Six months after graduation, 94% of our first degree graduates were in employment or further study (*HESA 2014/15*)

Our teaching is inspired by our research, 98% of which is of international quality (*2014 Research Excellence Framework*)

We have 21,000 students from 181 countries, and they are the most satisfied in the Russell Group (*NSS*)

## VISIT US TO FIND OUT MORE

### Open Days

You can register your interest now for our Open Days and receive priority access to book your place\*; visit [www.exeter.ac.uk/opendays](http://www.exeter.ac.uk/opendays)

\* Pre-registration only guarantees priority access to the booking system and is not an absolute guarantee of a place at any of our Open Days. Booking is essential and is on a first-come, first-served basis.

Exeter campuses:

Friday 2 June 2017

Saturday 3 June 2017

Saturday 2 September 2017

### Campus Tours

We run campus tours at the Streatham Campus each weekday, and at St Luke's Campus on Tuesdays and Fridays, during term time. You will be shown around by a current student, who will give you a first-hand account of what it's like to live and study at the University.

Phone: +44 (0)1392 724043

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[www.exeter.ac.uk/ug/computer-science](http://www.exeter.ac.uk/ug/computer-science)



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