



The School of Electronics and Computer Science is located at the University of Westminster's Cavendish

Campus in the centre of London, and offers a range of high-quality degrees at both undergraduate and postgraduate levels. We have over 70 full-time staff, more than 30 of who are engaged in research that was graded as of 'international quality' in the last research assessment exercise. All our staff are actively engaged in scholarship and teaching activities relevant to the discipline.

We are home to some 2,000 students with just over ten per cent taking postgraduate courses, and 15 per cent of our students are from a range of countries overseas. Many of our courses are professionally accredited and we run short courses to industry providing additional certifications. The School has an active portfolio of knowledge transfer partnerships, basic research grants and offers consultancies to a range of organisations particularly in health informatics, operational research, intelligent systems, parallel and distributed computing, semantic web, electronics and communications engineering. We offer placements in relevant industries to both large and small companies, and are particularly proud of our engagement with local employers in the city of London.

The School has recently completed a revision of its degree courses, and moved into a newly refurbished building designed to enable us to take on the future changes in higher education. The courses we offer have been validated by external advisors, and create a mix of applied skills across all the subject areas, from Business Information Systems through Computer Science, to Electronic, Network, and Systems Engineering. By joining us at Westminster you can be confident that you will receive an education that prepares you well for a career in IT or engineering, and equips you with the essential skills required to survive in a fast-paced industry.

This brochure gives you a more complete picture of our activities. If you feel that what you read fits with your aspirations or you would like to collaborate with us either as students, as a knowledge transfer partner, in research, or by providing short courses, we would like to hear from you.

Professor G M Megson
Dean, School of Electronics
and Computer Science

"YOU CAN BE CONFIDENT THAT YOU WILL RECEIVE AN EDUCATION THAT PREPARES YOU WELL FOR A CAREER IN I.T. OR ENGINEERING."

UNIVERSITY OF WESTMINSTER

SCHOOL OF ELECTRONICS AND COMPUTER SCIENCE POSTGRADUATE COURSES

FULL-TIME AND PART-TIME

COURSE ENQUIRIES
Second Floor
Cavendish House
101 New Cavendish Street
London W1W 6XH
T: +44 (0)20 7915 5511
E: course-enquiries@westminster.ac.uk

FOR POSTGRADUATE INFORMATION
EVENING DATES
visit our website
westminster.ac.uk

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For more than 170 years the University of Westminster has been a place where dedicated and creative students have enjoyed a vibrant learning environment, graduating with the skills they need to succeed in their chosen career.

As an international centre for learning and research, we are committed to continuing those traditions. We are leading the world in research in architecture, art, and media and communications, while our research work in areas such as business, computing, law, life sciences and the environment, and planning, has been recognised as internationally excellent. A wide range of our courses have also received excellent quality ratings.

Each year a diverse mix of students of many backgrounds and abilities join the Westminster family. We have more than 20,000 students from over 150 nations (a quarter of whom are postgraduates), studying with us this year.

From our prime locations across three large campuses in London's West End, we are well connected to the UK's major centres of business, government, law and science. Our fourth campus in Harrow is a hub for the study of technology and the creative industries, with its own on-site student village.

And we are continuing to invest in learning facilities and the student environment. We have started a major redevelopment of our students' facilities at our Harrow and Marylebone campuses, and a multi-million pound modernisation programme for our life sciences laboratories is also underway.



The University of Westminster has a long-standing reputation for innovation and creative development, and we showcase the work of our students and others at our P3 underground space at Marylebone Campus, and at the London Gallery West at Harrow Campus. Recently we opened a major new gallery space at our headquarters at 309 Regent Street, offering students and established artists the opportunity to exhibit work at this landmark location. The Regent Street building is also home to the UK's first public cinema, the venue for the country's first public moving picture show held by the Lumière brothers in 1896, and a major fundraising campaign is now underway to restore and modernise this site.

Studying for a postgraduate degree is a challenging but extremely rewarding experience. You will develop specialist knowledge, hone your professional skills, and enhance your career prospects. To help you achieve your aims, we offer a mature study environment and a broad range of courses that respond to and anticipate developments in professional life.

We have more than 900 teaching staff supported by a further 900 visiting subject specialists, delivering high-quality learning and research. Our libraries provide access to more than 380,000 titles, 25,000 e-journals, e-books, and hundreds of major commercial databases.

The team at our Career Development Centre can help you to find flexible work while you study, and whatever career you choose, they can help to develop your employability and offer advice on your path after graduation. Our extensive network of tutors, administrators, counsellors, health service, financial advisers and a chaplaincy is there to support you in every aspect of your life at Westminster, and our lively and active Students' Union offers a large number of student societies for a wide range of interests.

Westminster develops graduates who can succeed in an uncertain and increasingly international workplace. We hope to help you develop both the knowledge and the life skills you will need to succeed.





London is one of the world's most vibrant and exciting cities. From business, government and architecture to fashion, art, music, cinema and sport, London is where things tend to happen first. And as one of the city's 400,000 students, much of what happens in the capital is within your reach.

Importantly, making the most of London doesn't have to be expensive. With substantial student discounts and many of the city's attractions being free, you'll always find ways to make your money go further.

Despite the size of the city, travel is usually straightforward with good underground, bus (including night buses) and train networks, and student discounts available on Transport for London (TfL) travelcards. London is well connected by rail and road to the rest of the UK and Europe, and there are global air links through the city's five major airports.

The University of Westminster's central London campuses are within easy reach of many famous landmarks and institutions including the Houses of Parliament, the BBC, the London Stock Exchange, the British Library and the British Museum. Alternatively, if you choose to study in Harrow, you can combine the advantage of a residential green site with easy accessibility to all that London has to offer.

The University is also ideally located to network with the city's business leaders and employers, so we can offer great placements and work opportunities for our students. And with the British Library, the University of London Library and the archives of many institutions and professional bodies all close at hand, there is a huge variety of reference books and information to help you with your studies.

Culture and entertainment

London is home to more than 250 art and design galleries, over 600 cinema screens, and 200-plus theatres. The city also boasts a particularly vibrant music scene, ranging from rock, dance and pop, to world and classical music, a level of variety matched by London's exciting nightlife. And there is no shortage of places for socialising and dining out, with world cuisines represented at prices to suit everyone – you can eat out for as little as £5.

If your passion is for fashion and shopping rather than traditional culture, London is home to designers such as Paul Smith and Vivienne Westwood, and the city is famous for its markets.

Football, rugby, cricket and athletics are among the sports that feature high on London's leisure scene, at legendary venues such as Wembley, Twickenham and Lords. And the world's greatest sporting event, the Olympics, will be hosted here in 2012. But if you prefer your leisure activities to be more relaxed, London is a city of over 140 parks; 39 per cent of the city is green space.

With one of the UK's largest international student populations, the University of Westminster has plenty of experience in giving you the help and support you need to make the most of your time with us. Before you arrive, you will receive a full information pack with details of your enrolment, healthcare and other information. You will be regarded as a priority for accommodation, but it is still important to apply early. We also provide a 'meet and greet' service for students landing at Heathrow and Gatwick airports on specific days towards the end of September. Our team will meet you at the airport, and arrange transport for you to travel with other international students to your Halls of Residence or private accommodation.

Once you are here, we can give you comprehensive help and assistance including a whole range of services and activities to help you settle in. The International Students' Welcome Programme gives you the chance to meet fellow new students and Westminster staff, find your way around the University and London, learn about our facilities and services, and meet current international students. For more information visit westminster.ac.uk/international

Meet us in your country

Members of the University frequently travel overseas to meet and interview potential students at exhibitions, schools, partner institutions, alumni receptions and other events. We also work with representatives around the world who can help you with your application on our behalf. Visit westminster.ac.uk/international to see our calendar of visits and a full list of the overseas representatives we work with.

English language courses and support

We run a number of English language courses, from stand-alone short courses (including IELTS preparation) to specific Masters preparation and pre-sessional courses, as well as courses on English for Academic Purposes (EAP) westminster.ac.uk/efl



Pre-sessional English course

If you have been offered a place on a Masters or research degree at Westminster, our pre-sessional English course will help you to develop the language and study skills you will need. Over 11 weeks (if you have a current IELTS score of 5.5) or six weeks (for those with an IELTS score of 6.0), this intensive course will bring your English level up to the equivalent of an IELTS score of 6.5, the minimum requirement for most of our taught Masters courses and research programmes. For more information visit westminster.ac.uk/efl

Study Abroad Programme

Students currently enrolled in any university in the world can choose to study abroad at the University of Westminster for either a summer, semester or full year and transfer the Westminster credits to your degree. You can also choose to combine this experience with a workplacement, ensuring that your global skills set is enhanced even further.

If you missed out on a study abroad experience at the undergraduate level or are studying at the masters level, or even just wish to make a study abroad experience a part of your career development or year out activities, you can join our graduate study abroad programme for one semester and take a range of our graduate level modules.

For more information visit westminster.ac.uk/studyabroad



HOW TO APPLY AND ENTRY REQUIREMENTS

Taught Masters

The University of Westminster accepts applications through the national, online UK Postgraduate Application and Statistical Service (UKPASS) system. Once you have registered you can apply free of charge, and there is no application deadline for UKPASS, so you can make your course choices one at a time or all together; for more information and to apply, visit ukpass.ac.uk

You can also apply directly from the University website, either online via the individual course descriptions at westminster.ac.uk/courses, or by printing an application form from westminster.ac.uk/applicationform.

Alternatively you can contact our Course Enquiries team, T: +44 (0)20 7915 5511, E: course-enquiries@westminster.ac.uk. International students can get an application pack from one of our partners around the world; to find out more, visit westminster.ac.uk/study/international/meet-us-around-the-world

Entry requirements

Most courses have the following minimum standard entry requirements:

- a good first Honours degree from a recognised university, or qualification or experience deemed to be equivalent, and
- English language competency judged sufficient to undertake advanced level study, equivalent to an IELTS score of at least 6.5 (please see course criteria).

If your first qualification is from outside of the UK please look at westminster.ac.uk/international for information on our requirements from your country. Any specific entry requirements for a course are given in the course description.

Research degrees

Separate application and admission procedures apply for MPhil/PhD research degrees. Once you have checked that you meet the minimum entry requirements (westminster.ac.uk/study/rs), you should request an application pack, from the Research Team, Academic Services, University of Westminster; T: +44 (0)20 7911 5731, E: researchadmissions@westminster.ac.uk

You should complete the application form and include:

- an outline project proposal
- two confidential academic references
- appropriate academic transcripts
- evidence of English qualifications, if applicable.

If you are suitably qualified and we can offer supervision in your chosen area, you will need to attend a formal interview; telephone interviews may be arranged if you are based abroad. The admissions timetable is available at westminster.ac.uk/study/rs

Gaining credit for what you have learned

Your previous study or experience, whether through paid work or in a voluntary capacity, may mean you can gain exemption from some modules. However, it is up to you to make a claim if you think you may be eligible. The process is rigorous, but guidance is available from the admissions tutor or course leader of your preferred course of study. Credit will only be awarded for learning that is current and that relates to the aims and content of the course for which you are applying.

COURSE STRUCTURE

Masters of Science (MSc)

Full-time study

Courses last for one calendar year (48 weeks). You will probably attend the University for seminars or lectures at least two days a week during the teaching year (31 weeks). The delivery and assessment of taught modules will normally be carried out between September and June, but it's likely that you will need to study over the summer months for your independent research – usually a project or dissertation.

Part-time study

There are part-time routes in most subjects, and you can study during the day or the evening, or a mixture of both. Achieving a postgraduate qualification part-time normally takes at least a year (usually two), studying two evenings each week of the academic year, with a further six to 12 hours each week of personal study. Some employers enable you to study by day release from work, while intensive block study courses (see below) allow you to study full-time for one week followed by 12 weeks of personal study using an Independent Learning Package (ILP) approach.

Modular scheme

Modular study schemes are based on

a system of accumulating credits, and offer the most flexibility and choice in your course programme. You can transfer credits you have gained to other courses or institutions, and every course combines core and option modules which, as you complete them, bring you closer to gaining your higher degree.

Your previous study or experience, whether through paid work or in a voluntary capacity, may mean you can gain exemption from some modules. The Assessment of Prior Certificated Learning (APCL) accredits certificated learning such as Open University modules or in-company training. The Assessment of Prior Experiential Learning (APEL) recognises knowledge or skills acquired through life, work experience or study – such as computer programming or organisational skills – which have not been formally recognised by any academic or professional certification.

Intensive block study

Some Masters courses are offered in short, intensive study periods of one to four weeks. They are full-time and may include weekend and weekday study. Single postgraduate modules can sometimes be studied in this way.

MPhil/PhD courses

See the research section on p54.

ACCOMMODATION

After choosing your course, one of your biggest decisions will be where to live, and we aim to make that choice as easy as possible. Whether you decide to live in our halls of residence or in private housing, we can help you to find the right accommodation. For more details, virtual tours of our halls of residence and an online hall application form, visit westminster.ac.uk/study/student-accommodation

Halls of Residence

Postgraduate students based in central London can apply for a place in London halls, while Harrow-based students may apply for the on-site halls of residence. All halls are self-catering, usually with single study bedrooms. They have laundry facilities and shared kitchens with microwaves, cookers and fridge-freezers. Bedrooms are generally arranged in groups of flats, most of which accommodate six students.

Postgraduates in halls share flats with other postgraduates or with final year students. Other London halls offer a range of room types and prices, and are located very centrally or in areas with their own distinctive neighbourhood appeal. Wigram House is usually reserved for postgraduates only. If you are a full-time, full-year postgraduate you can apply online for a place in halls of residence as soon as you have firmly accepted your offer of a place on a course. Around two thirds of those who apply receive an offer of a place, and if you accept the offer you will need to pay a deposit and your rent in advance.

Private accommodation

If you prefer a more independent lifestyle, there is a huge supply of rented housing in London at a wide range of prices. Rents depend on where you live but, as an example, the majority of students studying in central London commute from travel zones 2 or 3 (just outside the central area), where you can expect to pay from £90 per week for a room in a shared flat or house.

We can offer all students comprehensive advice on finding suitable private accommodation, and a good starting

point is to attend one of our housing meetings in August and September. Here you can get a range of housing information and tips on successful flat hunting, as well as meeting other students to form groups to flat hunt together.

FEES, FUNDING AND SCHOLARSHIPS

Studying at university is a long-term investment in your future, and one which can make a significant difference to career prospects and your earning power. But to be able to make the most of your time at Westminster, it's also important to work out how you will pay your fees, accommodation and day-to-day expenses while you are here.

Most taught Masters fees are charged by band, although there are some exceptions. Fees increase each year, normally in line with the rate of inflation. However, there are currently major changes expected to be made regarding fees and student finance for September 2012, and for the latest information please visit westminster.ac.uk/fees and direct.gov/studentfinance

The University of Westminster has the most generous scholarship scheme of any British university. The value of the scheme for 2011 entry was close to £5m, including more than £2.5m in scholarships for our international students. We would hope to be able to continue provide similar levels of scholarship funding for 2012 and beyond. As soon as scholarship funding levels have been confirmed, we will publish details on our website, at westminster.ac.uk/scholarships; please check the site regularly for updates.

Once you have been offered a place (conditional or unconditional) on a postgraduate or PhD course you can apply for a scholarship, including alumni awards for Westminster graduates who wish to return to study at Masters level. Scholarships are competitive and have strict deadlines. The deadline for full-time UK and EU students is 2 April 2012, and for international students is 31 May 2012. For more information visit westminster.ac.uk/scholarships





If you study at the University of Westminster, everything that London has to offer is on your doorstep. Our central London campuses are ideally located for shopping, eating out, enjoying London's nightlife or just simply relaxing. As a University of Westminster student you will have access to all the facilities the University has to offer on all four of its campuses.

Cavendish Campus, situated in the artistic and bohemian area of Fitzrovia. Oxford Street, Regent's Park and the British Museum are only a ten-minute walk away and the peaceful Fitzroy Square just around the corner.

Marylebone Campus is opposite Madame Tussauds, just off Baker Street and close to the elegant shopping available on Marylebone High Street. Five minutes away is the vast green space of Regent's Park.

Regent Campus is situated on and around one of the busiest streets in London, home to a wide range of bustling shops, cafés and restaurants and just a couple of minutes walk from Oxford Street.

And in north-west London, **Harrow Campus** is just 20 minutes by Tube from central London, and close to Harrow town centre. Here you will find major retail stores, a civic centre, an arts centre and a multiplex cinema. Nearby Harrow-on-the-Hill is a historic village offering a richly contrasting atmosphere.

The University's School of Electronics and Computer Sciences is based at Cavendish Campus.

Campus Location
University of Westminster
115 New Cavendish Street
London W1W 6XH

BUSINESS INFORMATION SYSTEMS MSc

Length of course

One year, full-time or two years, part-time

Location

Central London (Cavendish)

Fees and funding

See westminster.ac.uk/fees

The demand for information technology specialists is steadily rising all over the world. The European Commission believes that even in a 'stagnation' scenario, demand for IT specialists will exceed supply within the EU, while all forecasts suggest that, as economic growth resumes, the demand for IT expertise will be even greater.

This innovative course responds to the latest developments in business practice. It examines the broader issues of business imperatives and technology responses that have changed the way information systems are perceived. It also addresses the key aspects of contemporary business information systems, from requirements analysis, system modelling and design to the development of modern software solutions and databases that can be incorporated into fully operational information systems.

You will explore the latest technologies and industry standards, with a particular emphasis on the web, internet applications, enterprise information systems, service-oriented and component-based development, and similar areas. By examining issues such as security, privacy and ethics in information systems, you will enhance your understanding of societal use of information systems.

The course provides an excellent vehicle for challenging postgraduate study, which will develop your skills for employment and professional life. The course is aimed both at graduates with a good Honours degree in an IT or computing-related discipline, and at practitioners who want to develop further their careers, update their technical skills and deepen their knowledge of emerging technologies.



COURSE CONTENT

The course contains three pathways or themes which enable you to specialise your studies in contemporary information systems, enterprise-wide information systems, and application development. Your course project consolidates the taught subjects of the course, while giving you the opportunity to pursue in-depth study in your chosen area. Teaching methods include lectures, student-led activity and smaller, instructor-led groups. Your course work will range from presentations and group investigations to software development or research review.

CORE MODULES

Architectures, Design and Deployment of IS

You will explore the role and applicability of component-based modelling and relevant platforms available from industry, within the process of developing Information Systems (IS).

Methods for Research and Industry

This module aims to develop your knowledge and competence of the research process, and the application of research methods in the area of Business Information Management.

Postgraduate Project Module

The project consolidates the taught subjects of the course, while giving you the opportunity to pursue in-depth study in your chosen area of Business Information Systems.

Requirements and System Modelling

This module introduces you to the discipline of requirement analysis through requirements modelling in order to capture, validate, specify and manage requirements in Information Systems Development (ISD) projects. You will also focus on the analysis of risks and failures of ISD projects, with emphasis on the role of requirement analysis when building 'right' systems.

OPTION MODULES

Business Systems Programming

This module provides you with a solid foundation in programming in general, and object-oriented programming in particular. You will use Java to cover topics such as data structures, GUI programming, applets, programming with database, and server-side programming for the internet (using JSP). You will study object-oriented concepts to re-use existing solutions and facilitate new designs of software components; fundamentals of Java programming; how to handle events through programming; and how to design and implement web-based applications communicating with a database.

Computing for Business and Management

You will cover topics in computing considered essential for business and industry. These will include the spreadsheet as a tool for developing decision-support applications; event-driven and object-oriented programming and GUI generation (eg VBA); and the construction of databases, with emphasis placed on integrating MS Access and MS SQL Server with other applications to create decision-support applications.

Data Management and Repositories

You will cover theoretical and practical issues related to technologies employed for the persistent storage of data. The module discusses and evaluates the underlying technologies used in capturing, maintaining and modelling persistent data. Pursuing this, you will examine the evolution of database management systems, their components and functionality, along with some of the predominant and emerging data models.

Data Warehousing and OLAP

The module focuses and addresses recent technological developments in integrating and analysing large amounts of business data that today's transactional/operational enterprise systems are capable of collecting. You will explore multi-dimensional modelling, the integration of



multi-source data and analysis, aiming to support better business decision making. Most of the topics covered in lectures will be associated with a number of supervised, Oracle-supported computer laboratory/workshop sessions. The exercises and study materials used in these sessions will utilise material and courseware drawn from Oracle documents and Oracle university courses.

Database Languages

Through this module you will discuss in detail the features and constructs of the SQL, the de-facto database language for the definition and manipulation of relational-data constructs. The module also covers procedural aspects of the language and issues related to the efficient use of and client/server programming constructs. The module is a hands-on skills module; the exercises and materials used in the delivery of the module are based on Oracle University materials, and you will have access to Oracle courseware that can help you with your preparation for Oracle Certification exams.

Enterprise Utility Computing

You will focus on technologies and software delivery methods based on the utility computing model at the networked enterprise. The module gives you an overview of the underlying concepts of utility computing, such as its business and service provisioning model, outsourcing, and virtualisation. You will also examine how clusters, grids and clouds can be

utilised for enterprise computing, and what new challenges are raised regarding quality of service, security, and ethical and legal issues.

IT Business Models

This module provides you with an overview of emerging IT business models in the context of e-business and enterprise computing. You will cover different e-business models (B2B, B2C, B2A), and analyse the relationship between e-business/e-commerce front-ends and enterprise resource planning systems. You will also examine emerging B2C and B2B business revenue models based on the e-enterprise from technological, business, legal and ethical perspectives.

Project Management

You will examine the role of the project manager, together with the techniques used for project planning, scheduling, monitoring and controlling projects throughout the project life cycle. The PRINCE2® project management method is used as a framework for understanding the key issues, providing you with practical experience in using a project management software tool for project scheduling.

Semantic and Collaborative Technologies

This module will provide you with skills in manipulating XML-based and semantic web technologies, for modelling, querying and reasoning about distributed and interoperable data over the internet. You

will understand the general vision and impact of collaborative and semantic web technologies and their applications, and be able to describe web resources in RDF and RDF schemas for supporting semantic interoperability and defining vocabularies for web resources. You will also learn how to develop, validate and query metadata documents in XML-based technologies, engineer ontologies using semantic web languages, and query and reason about ontologies using formal and descriptive logics.

Social Systems

This module focuses on the use of social systems in enterprises. You will be introduced to the underlying theory, the technology that enables the social system and the application areas within enterprises and organisations.

Systems Interoperability

This module analyses the problem of interoperability in data centric applications and gives you an insight into different approaches that addressed the problem in the last decade. You will focus on the impact of internet technologies on the interoperability of current database systems, discuss standards for data interchange and address interoperability of distributed heterogeneous database applications using XML-based web services.

Web-Enabled Database Applications

The module offers a study in the field of server-side and client-side scripting, and you will be presented with techniques for creating dynamic web pages, while a server-side language will be covered to the depth required for implementing functional applications. The module aims to examine alternative methods for the development of dynamic web applications; to equip you with the ability to analyse, evaluate and implement web-based business applications; to provide an introduction to using a server-side language for the development of web applications; and to enable you develop a theoretical and practical knowledge of the W3C.

ASSOCIATED CAREERS

Graduates can expect to find employment as business intelligence consultants, business systems analysts and designers, enterprise consultants and managers, ETL marketers, and ETL/OLAP programmers and application developers. Recent graduates have found employment with a range of organisations including Accenture, the British Council, Centaur Holdings PLC, Deutsche Bank, Foreign and Commonwealth Office, GlaxoSmithKline, Home Office, IBM, Logica, Merrill Lynch, Nationwide, PricewaterhouseCoopers, Standard and Poor's, University of Hertfordshire, Taylor Woodrow, and a number of local authorities.

ENTRY REQUIREMENTS

You are expected to have a good Honours degree (at least a Lower Second) from a UK university (or overseas equivalent) in an IT or computing discipline, or in another discipline that is either closely related to IT or computing (eg economics and business studies), or provides important underpinning for/insight into it (eg sciences or engineering). You may also be considered according to work experience and other qualifications. If your first language is not English you will need an IELTS score of 6.5 or equivalent.

RELATED COURSES

- Business Intelligence and Analytics MSc
- Database Systems MSc



BUSINESS INTELLIGENCE AND ANALYTICS MSc

Length of course

One year, full-time or two years, part-time

Location

Central London (Cavendish)

Fees and funding

See westminster.ac.uk/fees

This course addresses the need to propel information gathering and data organisation, and exploit potential information and knowledge hidden in routinely collected data to improve decision making. The course, which builds on the strengths of two successful courses on data mining and on decision sciences, is more technology focused, and stretches the data-mining and decision-sciences theme to the broader agenda of business intelligence.

You will focus on developing solutions to real-world problems associated with the changing nature of IT infrastructure and increasing volumes of data, through the use of applications and case studies, while gaining a deep appreciation of the underlying models and techniques. You will also gain a greater understanding of the impact technological advances have on the nature and practices adopted within the business intelligence and analytics environments, and know how to adapt to these changes.



COURSE CONTENT

Embedded into the course are two key themes. The first will help you to develop your skills in the use and application of various technologies, architectures, techniques, tools and methods. These include data warehousing and data mining, distributed data management, and the technologies, architectures, and appropriate middleware and infrastructures supporting application layers.

The second theme will enhance your knowledge of algorithms and the quantitative techniques suitable for analysing and mining data and developing decision models in a broad range of application areas. The project consolidates the taught subjects covered, while giving you the opportunity to pursue in-depth study in your chosen area.

Teaching approaches include lectures, tutorials, seminars and practical sessions. You will also learn through extensive coursework, class presentations, group research work, and the use of a range of industry standard software such as SAS, SPSS, iThink, Simul8, MS SQL Server 2005 Analysis Services, and Oracle Data Mining Suite. Taught modules may be assessed entirely through coursework, or may include a two-hour exam at the end of the year.

CORE MODULES

Data Mining

The module provides you with an in-depth analysis of the most practical topics in data mining and knowledge discovery, such as decision tree and other classification methods, association analysis, clustering and statistical mining.

Project

The project module plays a unifying role and it aims to encourage and reward your individual inventiveness and application of effort. The scope of the project is not only to complete a well-defined piece of work in a professional manner, but also to place the work into the context of the current state of the art in business intelligence and/or analytics.

Research Methods and Professional Practice

You will strengthen your skills for the research and industry needs of the course, the final project, and for your future career and study. The module guides your personal development plan towards the professional requirements of the discipline, and covers methods of critical evaluation, gathering and analysing information, and preparing and defending a project proposal.

Statistics and Operational Research

This is a self-contained module in applied statistics and operational research that lays the foundations for more advanced modules in data mining and analytics. You will cover topics such as hypothesis testing, regression, forecasting, linear programming and network modelling, and use software such as EXCEL Solver, SPSS, R, SAS, and AIMMS.

OPTION MODULES

Business Optimisation

This module provides you with an in-depth analysis of advance topics in operational research, such as discrete optimisation, multiple criteria optimisation and modern heuristic approaches.

"The course not only challenged and stretched me, it exposed me to such a variety of tools, concepts and systems that I have walked away more prepared to face the challenges of an ever-changing and complex business world. In some respects it's like putting on 3D glasses for the first time and seeing angles, dimensions and views you would never have seen otherwise."

COLIN RIDLEY, GRADUATE
GLOBAL PRICING MANAGER,
ETIHAD AIRWAYS



Computing for Business and Management

You will cover topics in computing considered essential for business and industry. These will include the spreadsheet as a tool for developing decision-support applications; event-driven and object-oriented programming and GUI generation (eg VBA); and the construction of databases, with emphasis placed on integrating MS Access and MS SQL Server with other applications to create decision-support applications.

Data Management and Repositories

You will cover theoretical and practical issues related to technologies employed for the persistent storage of data. The module discusses and evaluates the underlying technologies used in capturing, maintaining and modelling persistent data. Pursuing this, you will examine the evolution of database management systems, their components and functionality, along with some of the predominant and emerging data models.

Data Warehousing and OLAP

The module focuses and addresses recent technological developments in integrating and analysing large amounts of

business data that today's transactional/operational enterprise systems are capable of collecting. You will explore multi-dimensional modelling, the integration of multi-source data and analysis, aiming to support better business decision making. Most of the topics covered in lectures will be associated with a number of supervised, Oracle-supported computer laboratory/workshop sessions. The exercises and study materials used in these sessions will utilise material and courseware drawn from Oracle documents and Oracle university courses.

Database Languages

Through this module you will discuss in detail the features and constructs of the SQL, the de-facto database language for the definition and manipulation of relational-data constructs. The module also covers procedural aspects of the language and issues related to the efficient use of and client/server programming constructs. The module is a hands-on skills module; the exercises and materials used in the delivery of the module are based on Oracle University materials, and you will have access to Oracle courseware that can help you with your preparation for Oracle Certification exams.

Project Management

You will examine the role of the project manager, together with the techniques used for project planning, scheduling, monitoring and controlling projects throughout the project life cycle. The PRINCE2® project management method is used as a framework for understanding the key issues, providing you with practical experience in using a project management software tool for project scheduling.

Risk Modelling and Simulation for Business and Industry

This module focuses on the choice and use of appropriate simulation models to treat real-world problems, developing solution(s) using powerful Monte Carlo and discrete-event simulation software such as @RISK and SIMUL8, and explaining the business and industrial implications thereof. It will also give you concepts of analytical methods if and when appropriate, such as influence diagrams and queuing theory.

Web Mining

You will cover the fields of information retrieval and text mining. In the first you will be given an overview of how search engines work, why they are successful and to some degree how they fail. In the second part of the module you will focus on case studies drawn from scientific research and business to study essential text mining algorithms.

You may take instead another module from the School postgraduate portfolio, at the course leader's discretion.

ASSOCIATED CAREERS

Graduates can expect to find employment as consultants, decision-modelling or advanced-data analysts, and members of technical and analytics teams supporting management decision making in diverse organisations. Typical employers include local authorities, PLCs (such as GlaxoSmithKline, Prudential, Santander and Unilever), public sector organisations (such as the NHS and primary care trusts), retail head offices, the BBC, the Civil Service, and the host of banks, brokers

"The MSc I completed at Westminster provided me with really useful and relevant tools and techniques to take forward in my subsequent career. Eight years on, I still use many of the elements I learned on this course, ranging from detailed analyses of real operational problems in the workplace, to clear and effective stakeholder engagement."

RUTH NEWSOME, GRADUATE
CAPABILITIES PROGRAMME MANAGER,
UNILEVER PROCUREMENT

and regulators that make up the City, along with all the specialist support consultancies in IT and market research and forecasting, all of whom use data for the full range of decision making.

ENTRY REQUIREMENTS

You are expected to already have quantitative skills, with an interest in developing these further to support postgraduate activity in analysing, evaluating and reporting on a range of real-world data-intensive problems. You will have a suitable Honours degree from a UK university (or equivalent qualification) in a scientific or engineering discipline with some exposure to the use of IT, or in an area of computer science or IT with a strong interest in quantitative analysis. If you do not have a formal qualification, but you are already in employment, you may be considered if your role involves the data-mining and decision-support techniques and technologies deployed in the course. If your first language is not English you will need an IELTS score of 6.5 or equivalent.

RELATED COURSES

- Business Information Systems MSc
- Database Systems MSc

DATABASE SYSTEMS MSc

Length of course

One year, full-time or two years, part-time

Location

Central London (Cavendish)

Fees and funding

See westminster.ac.uk/fees

This course has been designed to enhance your professional abilities, and deepen your knowledge and understanding of emerging, state-of-the-art database technologies. It will equip you with the range of highly marketable, hands-on skills required in data modelling, and in designing, managing, monitoring and administering corporate database systems divisions, information centres and web-enabled database applications.

The course combines academic study with Oracle certification training, and you will be encouraged to take the associated Oracle exams and become an Oracle Certified Associate. It is suitable for recent graduates who wish to study for a higher qualification and/or gain relevant technical and professional skills in database systems. It's also a strong course for practitioners looking to enhance their professional abilities, develop their careers, and update their technical skills, knowledge and understanding of state-of-the-art and emerging technologies.



COURSE CONTENT

The course addresses new technologies, and advanced theories and techniques, along with their application, implementation and integration with legacy systems. You will analyse new demands and the application of new technologies in the management of data and information resources, and examine emerging technologies shaping the way data is now processed, accessed, retrieved, structured and modelled.

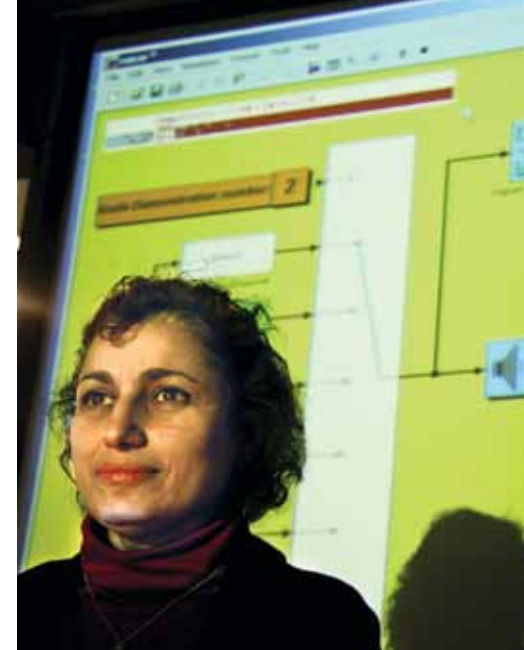
The course offers three specialist pathways or themes which can lead you to different areas of the database systems environment. One pathway leads to roles related to database administration and the ability to deliver and administer web-enabled database solutions. A second pathway leads to roles related to database application development, and the ability to deliver web-enabled information systems solutions. The third pathway focuses on the role of data architect, and the skills and knowledge needed to organise and design data and manage projects in a way that harnesses potential emerging technologies.

Teaching methods include lectures, student-led activity and smaller, instructor-led groups. You are encouraged to gain greater understanding of topics through practical activity and the use of scaled down versions of real life scenarios. The Oracle training materials that we use will prepare you to take the Oracle Certified Associate (OCA) exams. Assessment usually involves a combination of exams and coursework, leading to a product such as a presentation, group investigation, technical solution, a piece of software or a research review. Exams are normally two hour long and take place at the end of the year.

CORE MODULES

Business Information System Postgraduate Project Module

The project module plays a unifying role, and aims to encourage and reward your individual inventiveness and application of effort. It is an exercise that may take a variety of forms and which provides you with the experience of planning and bringing to fruition a major piece of individual work.



Business Systems Programming

This is a hands-on module that uses Java to develop your programming skills and to give you a good practical understanding of object-oriented programming and concepts. Topics covered include data structures, GUI programming, applets, database connectivity, server-side programming (using JSP). As part of the module, you will learn the fundamentals of Java programming; how to handle events through programming; how to design and implement web-based applications communicating with a database and how object-orientation can enable you to re-use existing solutions and to facilitate new designs of software components.

Database Languages

This is a hands-on module that develops your database skills for the definition and manipulation of data constructs. You will use Oracle's SQL to learn the features and constructs that contemporary ad hoc Database Query Languages offer; Oracle's PL/SQL is used to teach the procedural and object-relational aspects of Data Query Languages; issues related to the efficient use of client/server programming constructs are also addressed. You will be given access to Oracle courseware that can help you with your preparation for Oracle Certification Exams, whereas the exercises and teaching materials used in this module are based on Oracle University materials.

Data Management and Repositories

You will learn about the theoretical and practical issues related to technologies employed for the persistent storage of data. This module discusses and evaluates the underlying technologies used in capturing, maintaining and modelling persistent data. Pursuing this, the evolution of Database Management Systems, their components and functionality will be discussed, along with some of the predominant and emerging data models.

Research Methods and Professional Practice

This module will develop further your research and industry skills required for your professional development, future career and study. Among the skills that will be strengthened are those related to the awareness of the professional, legal and ethical issues, the critical evaluation, the collection and analysis of information, and the development and defence of a sound project proposal.

OPTION MODULES

Data Warehousing and OLAP

The module focuses and addresses recent technological developments in integrating and analysing large amounts of business data that today's transactional/operational enterprise systems are capable of collecting. You will explore multi-dimensional modelling, the integration of multi-source data and analysis, aiming to support better business decision making. Most of the topics covered in lectures will be associated with a number of supervised, Oracle-supported, computer laboratory/workshop sessions. The exercises and study materials used in these sessions will utilise material and courseware drawn from Oracle documents and Oracle university courses.

Database Administration and Management

The module provides you with extensive coverage of the principles of database administration, including transaction management and control, backup and recovery, availability and security. It aims to define the role of the database

administrator, to provide an in-depth appreciation of the underlying technical issues involved in managing a database within an organisation, and to investigate the mechanisms that are available to handle the additional complexity that arises from managing distributed and replicated data. Lectures and tutorials will be complemented by special workshops covering issues related to concepts and technologies used to administer Oracle installations. The exercises and materials used in these workshops will be drawn from materials used in Oracle University courses.

Enterprise Utility Computing

You will focus on technologies and software delivery methods based on the utility computing model at the networked enterprise. The module gives you an overview of the underlying concepts of utility computing, such as its business and service provisioning model, outsourcing, and virtualisation. You will also examine how clusters, grids and clouds can be utilised for enterprise computing, and what new challenges are raised regarding quality of service, security, and ethical and legal issues.

IT Business Models

This module provides you with an overview of emerging IT business models in the context of e-business and enterprise computing. You will cover different e-business models (B2B, B2C, B2A), and analyse the relationship between e-business/e-commerce front-ends and enterprise resource planning systems. You will also examine emerging B2C and B2B business revenue models based on the e-enterprise from technological, business, legal and ethical perspectives.

Project Management

You will examine the role of the project manager, together with the techniques used for project planning, scheduling, monitoring and controlling projects throughout the project life cycle. The PRINCE2® project management method is used as a framework for understanding the key issues, providing you with practical experience in using a project management software tool for project scheduling.

Requirements and System Modelling

This module introduces you to the discipline of requirement analysis through requirements modelling in order to capture, validate, specify and manage requirements in Information Systems Development (ISD) projects. You will also focus on the analysis of risks and failures of ISD projects, with emphasis on the role of requirement analysis when building 'right' systems.

Semantic and Collaborative Technologies

This module will provide you with skills in manipulating XML-based and semantic web technologies, for modelling, querying and reasoning about distributed and interoperable data over the internet. You will understand the general vision and impact of collaborative and semantic web technologies and their applications, and be able to describe web resources in RDF and RDF schemas for supporting semantic interoperability and defining vocabularies for web resources. You will also learn how to develop, validate and query metadata documents in XML-based technologies, engineer ontologies using semantic web languages, and query and reason about ontologies using formal and descriptive logics.

Systems Interoperability

This module analyses the problem of interoperability in data centric applications and gives you an insight into different approaches that addressed the problem in the last decade. You will focus on the impact of internet technologies on the interoperability of current database systems, discuss standards for data interchange and address interoperability of distributed heterogeneous database applications using XML-based web services.

Web-Enabled Database Applications

The module offers a study in the field of server-side and client-side scripting, and you will be presented with techniques for creating dynamic web pages, while a server-side language will be covered to the depth required for implementing functional applications. The module aims to examine alternative methods for the development of

dynamic web applications; to equip you with the ability to analyse, evaluate and implement web-based business applications; to provide an introduction to using a server-side language for the development of web applications; and to enable you develop a theoretical and practical knowledge of the W3C.

Web Mining

You will cover the fields of information retrieval and text mining. In the first you will be given an overview of how search engines work, why they are successful and to some degree how they fail. In the second part of the module you will focus on case studies drawn from scientific research and business to study essential text mining algorithms.

You may also take another module from the postgraduate portfolio, at the course leader's discretion.

ASSOCIATED CAREERS

Graduates can expect to find employment as business systems analysts and designers, data analysts, database administrators, database application developers, database systems consultants, information resources managers, systems designers and systems integrators. Recent graduates have joined a variety of organisations, including Bank of America, the Metropolitan Police, Network Rail, and a number of local authorities.

ENTRY REQUIREMENTS

You are expected to have a good Honours degree (at least a Lower Second) from a UK university (or overseas equivalent) in an IT or computing discipline, or in another discipline that either provides important underpinning for or insight into IT and computing, or it is closely related to it (eg sciences or engineering). You may also be considered according to work experience and other qualifications. If your first language is not English you will need an IELTS score of 6.5 or equivalent.

RELATED COURSES

- Business Information Systems MSc
- Business Intelligence and Analytics MSc

INFORMATION TECHNOLOGY SECURITY MSc

Length of course

One year, full-time, or two years, part-time, block mode

Location

Central London (Cavendish)

Fees and funding

See westminster.ac.uk/fees

In contemporary society, the importance of gathering, organising and manipulating data is well known. Virtually every business activity – public and private – requires the storage of large quantities of information in a format that is readily available and easily updated. Securing the integrity, privacy and confidentiality of this knowledge is essential.

This innovative and flexible course gives you the skills to assess faults and risks in an IT environment, develop a sound ethical IT security policy and security management structure, and manage and control computer networks with due regard for IT security. As well as building IT security into new software and hardware system implementations, you will be able to ensure user compliance with agreed security policy, and prevent and – if necessary – manage crises.

COURSE CONTENT

The course is taught in block mode of one week's intensive teaching in dedicated postgraduate rooms, followed by a period of about one month when assignments are completed. It's a course structure that is very popular with both employees and employers.

Alongside the state-of-the-art Learning Resource Centre, you will also benefit from 20 computer laboratories equipped with more than 600 workstations, five dedicated network development and testing rooms, an advanced multimedia laboratory, and video conferencing backbone line to the national Super-Janet network.



CORE MODULES

IT Security Postgraduate Project

This module is the culmination of the course. It is an opportunity for you to put into practise many of the skills learned elsewhere on the course. It is a major piece of work on a topic chosen by you (normally, this topic will be chosen as part of the Research Methods module). You will undertake this work individually, and will be assigned a project supervisor to assist with and guide the development of the project.

IT Threats and Counter-Measures

This module enables you to understand the threats to IT systems and to information held on these systems from inside and outside the computer, to establish what standards are applicable, and to know the contents of these standards, how they are applied, and how they assist in forming procedures in IT security. You will learn to understand how software tools can be used to speed up and/or automate detection of threats to be able to counter the threats covered, and to assess the practical and economic viability of using appropriate counter-measures based on the assessment of risk.

Methods for Research and Industry

This module will develop further your research and industry skills required for your professional development, future career and study. Among the skills that will be strengthened are those related to the awareness of the professional, legal and ethical issues, the critical evaluation, the collection and analysis of information, and the development and defence of a sound project proposal.

Security Awareness

This module is concerned with the role of IT security as a part of an overall company security policy. The topics you will study include: computer crime, the rapidly changing IT security environment, writing a security policy and security standard operating procedures (SOP), security analysis, post-incident reviews, roles and responsibilities, interpersonal skills, and interviewing techniques.

OPTION MODULES

Biometric Security Systems

You will gain an overview of the applications of biometrics to security through this

module. The topics you will cover include the application of biometrics in volume commercial and consumer markets, and the accuracy of varying modalities such as fingerprint, iris, face and behaviour. You will also explore biometric standards, privacy and interoperability.

Computer Forensics Fundamentals

This module gives you an introduction to some of the general concepts of computer forensics, as well as helping you to develop the skills that will be needed on other modules. You will cover in detail the layout of volumes on storage devices, and file systems within volumes, with particular emphasis on the FAT file system. You will learn to look at raw devices using low-level tools like hex editors, and gain familiarity with the Unix operating system.

Computer Forensics Tools

This module looks at a range of tools that might be used by a forensic examiner. You will consider high-level tools like EnCase, FTK and Autopsy, although your main focus will be on low-level tools such as dd and the Sleuthkit tools, as these help to develop your understanding of what (and how) the higher level tools are actually doing. In addition you will learn a scripting language (currently Perl) so that you can develop your own forensic tools.

IT Security Evidence and Procedure

You will examine the legal obligations



of computer forensics, gaining an understanding of the relevant statutes and industry guidelines, and of proving the authenticity of evidence via a chain of custody from collecting evidence through to presenting findings in a professional manner. The module also aims to provide you with a broad understanding of the professional factors that influence the work of professional practitioners, particularly in the context of the 'Expert Witness'.

Risk Management

IT risks are managed by the identification of risk and controlling the risks. This module will focus on the two main areas of risk identification and risk control. You will explore various risk control strategies, and investigate automated tools for risk assessment, as well as various protection mechanisms.

ASSOCIATED CAREERS

Some of the senior staff supporting this course offer permanent posts to graduates. For others, an e-group has been set up for all past and present students. This enables the two groups to talk to each other, and puts employers in touch with students when a position needs filling. It is a feature that is much appreciated by those seeking either new employment or advancement in the IT security field.

ENTRY REQUIREMENTS

You will have a suitable Honours degree from a UK university (or equivalent qualification); this does not necessarily need to be in a computing discipline, or have a substantial computing component, but you must be computer oriented. Those employed in an industrial or academic context with an interest in IT security will also be considered. If your first language is not English you will need an IELTS score of 6.5 or equivalent.

RELATED COURSES

- Computer Forensics MSc
- Computer Networks MSc
- Computer Science MSc
- Mobile, Wireless and Broadband Communications MSc



COMPUTER FORENSICS MSc

Length of course

One year, full-time or two years, part-time

Location

Central London (Cavendish)

Fees and funding

See westminster.ac.uk/fees

Computer crime is increasingly widespread and sophisticated, and there is a growing need for computing professionals qualified to deal with it. This course combines technical computer forensic skills with the requirements of an expert witness. You will gain experience of a range of current and certified forensic tools, as well as investigating relevant professional, legal and ethical issues.

You will benefit from a broad and varied array of state-of-the-art technologies, including:

- EnCase, FTK and open-source forensic tools, and a dedicated forensics computer laboratory
- Sunray servers connected to a 1GB fibre optic network with links to both the Super-Janet 4 network and the London Metropolitan Network, connecting the Greater London education and research community
- a Uni-Backbone network that supports IP Multicasts to deliver a constant stream of interactive, multimedia-rich content
- over 20 laboratories providing access to Unix, Novell and NT servers, all supported by high-bandwidth networks
- specialist technicians to ensure you can get the most out of these technologies.



COURSE CONTENT

You will examine a variety of tools available on the open market, and the use of forensic tools to retrieve data from electronic sources. You will also consider the analysis of professional and ethical issues relating to computer forensics, and the development of professional competencies, such as report writing and presenting evidence in court.

Teaching methods include lab-based sessions, student-led tutorials and lectures by internal staff and guest speakers from industry. Our courses are offered by friendly, highly experienced staff, and benefit from the diverse specialist knowledge and skills within the departments of the School. Assessments will be carried out mostly through practical or research-based course work and in-class tests.

CORE MODULES

Advanced Computer Forensics

This module continues the examination of essential digital forensics concepts. The topics you will cover include network forensics, live systems, mobile phones and other devices. A further aim of the module is to introduce you to developing areas of computer forensics, and provide you with the skills to investigate new areas of computer forensics, such as covert analysis and intruder artefacts.

Computer Forensics Fundamentals

This module gives you an introduction to some of the general concepts of computer forensics, as well as helping you to develop

the skills that will be needed on other modules. You will cover in detail the layout of volumes on storage devices, and file systems within volumes, with particular emphasis on the FAT file system. You will learn to look at raw devices using low-level tools like hex editors, and gain familiarity with the Unix operating system.

Computer Forensics Tools

This module looks at a range of tools that might be used by a forensic examiner. You will consider high-level tools like EnCase, FTK and Autopsy, although your main focus will be on low-level tools such as dd and the Sleuthkit tools, as these help to develop your understanding of what (and how) the higher level tools are actually doing. In addition you will learn a scripting language (currently Perl), so that you can develop your own forensic tools.

Computer Systems Security

You will examine the issues involved with recognising security threats to computer systems, their consequences and methods of dealing with such threats. In particular, you will gain an overview of security issues for databases, operating systems and networked systems, and consider the relationship between computer forensics and computer security. The module also considers the consequences of security threats in terms of privacy, integrity, availability and accountability, and the selection and evaluation of different approaches to building and enhancing secure systems.

Data Recovery and Analysis

You will cover many of the most important concepts of digital forensics through this module, including various methods of data recovery (noting those that meet ACPO guidelines for evidence preservation). Analysis of the data will include finding and recovering deleted files, searching slack space on storage devices, examining log and registry entries, and constructing timelines of activity.

Evidence and Procedure

You will examine the legal obligations of computer forensics, gaining an understanding of the relevant statutes and industry guidelines, and of proving the authenticity of evidence via a chain of custody from collecting evidence through to presenting findings in a professional manner. The module also aims to provide you with a broad understanding of the professional factors that influence the work of professional practitioners, particularly in the context of the 'Expert Witness'.

Postgraduate Project Module

This module is the culmination of the course. It is an opportunity for you to put into practise many of the skills learned elsewhere on the course. It is a major piece of work on a topic chosen by you (normally, this topic will be chosen as part of the Research Methods module). You will undertake this work individually, and will be assigned a project supervisor to assist with and guide the development of the project.

Research Methods

This module is shared with other MSc courses run by the Department. Its main focus is on introducing you to research, and developing the skills you need to read and evaluate original research literature. This in turn leads into the Project, and a major outcome of the module should be a Project Proposal. In addition, the module addresses certain aspects of PDP.

ASSOCIATED CAREERS

The course is intended for those involved with, or wishing to be involved with, corporate computer forensics or law enforcement computer forensics. Successful graduates will be able to safeguard the chain of digital evidence of potentially illegal or improper activity, from detection, safe collection and preservation, through to analysis and presentation in a court of law. Employment opportunities range from supporting the police and associated law enforcement agencies to computer security and computer audit roles in commercial companies.

ENTRY REQUIREMENTS

You are normally expected to have a good Honours degree (at least Upper Second Class) in a computing-related discipline from a UK university or overseas equivalent. If your first degree does not have a strong computing content, you will need to demonstrate that you have sufficient knowledge or industry experience of computing. Your work experience and other qualifications may also be taken in to account.

You must submit a statement of purpose with your application in which you should present your key interests and career aspirations, how you believe the course can help you to achieve these, and what relevant personal qualities and experience you will bring to the course. You may be invited by the admissions tutor to an informal interview.

If your first language is not English you will need an IELTS score of 6.5 or equivalent.

RELATED COURSES

- Information Technology Security MSc
- Software Engineering MSc

COMPUTER SCIENCE MSc

Length of course

One year, full-time, or two to five years, part-time

Location

Central London (Cavendish)

Fees and funding

See westminster.ac.uk/fees

This redesigned course focuses on the specific emerging domains within computer science and software engineering, where there is increasing industry demand and a skills shortage. It will enable you to develop the skills and knowledge you need to build your career in these new and important areas of computer science, significantly enhancing your employment opportunities while also providing a solid core of good software engineering practice that will enhance and reinforce your existing skills.

COURSE CONTENT

Among the areas you will cover is the development of sophisticated touch surface devices such as the iPad and the iPhone, which requires skills in native programming techniques, graphics and animation, and mobile application development. The course includes modules that will give you the knowledge and practical techniques to develop applications for these new devices, covering the rich, user-centric, multiple-touch client software and the web-based service that this software consumes.

The course also covers the increasingly important area of resource virtualisation, services and systems administration. Businesses are now regularly using virtualised systems and techniques to lower costs and complexity and increase availability in computing environments. This course has a pathway of modules that will impart these principles and practice and provides a solid foundation for you to gain entry into this specialism.



CORE MODULES

Computer Science Project

You will undertake an extended, individual piece of work on an approved topic, which unifies and extends the theoretical and practical knowledge of software engineering by applying them to develop a software application. A supervisor will provide you with guidance on planning, development, documentation and demonstration.

Enterprise Application Development

This module introduces you to the development of a distributed application within a contemporary software framework such as .NET and J2EE. You will examine the underlying principles and apply them to the development of typical n-tier application. You will consider both stationary and mobile applications will be considered. Other topics covered include: enterprise development frameworks, client, business, repository layers and MVC design pattern, event-driven programming, GUI applications, storage and file handling, database access, and web services.

iPhone Application Development

You will gain the necessary knowledge and practical experience to develop applications for native platforms through this module. It will give you the skills to produce applications that take advantage of the underlying hardware features of contemporary mobile devices, such as smartphones and multi-touch surfaces, location features, and natural gesturing through combination of accelerometer and touch surfaces.

Mobile Application Development

The module examines the use of application development technology for mobile devices including Java-enabled devices and Android.

Pervasive Computing and Interactive Systems

The module is designed to give you a theoretical and practical background to the development of immersive environments for various platforms, using industry standard toolkits. You will focus particularly on the algorithms, theories and design of new digital media, and their application

to multi-platform environments such as mobile interfaces, pervasive games, web applications and web logs (blogs), interactive installations, interactive museum guides, and virtual and augmented environments.

Research Methods

This module is shared with other MSc courses run by the Department. Its main focus is on introducing you to research, and developing the skills you need to read and evaluate original research literature. This in turn leads into the Project, and a major outcome of the module should be a Project Proposal. In addition, the module addresses certain aspects of PDP.

Resource Virtualisation

Virtualisation introduces abstraction into hardware and software architectures. This abstraction enables creating hardware and software solutions independent of complex low-level details using a black box model. As a result, software sitting on top of this black box should not know what is happening inside this box. Virtualisation enables workload consolidation and allows interoperability among different hardware and software platforms, also providing a more robust and secure computing environment. The module covers major aspects of virtualisation, particularly hardware virtualisation (processor, memory, storage, network) on one side and software virtualisation (application and operating system) at the other side.

Service-Oriented Architectures and Web Services

You will explore software-oriented architecture and web services including its architecture, features, standards (such as WSDL, UDDI and SOAP) and implementations. The module covers analysis, design, development, installation and maintenance issues of web services-based applications. You will gain theoretical knowledge by learning the service-oriented architecture (SOA), web services models, and web services standards, and practical skill by designing and developing web services-based applications.

Software Engineering Context

You will examine the nature of software engineering and important external factors that influence the work of a practising software engineer. In particular you will explore software engineering life cycles, requirements engineering, user-interface design, software quality assurance, testing, and selected professional issues.

In addition you will pursue a pathway of your choice, selected with the guidance and advice of our academic staff. You can choose up to five of the following pathways modules:

Systems Administration

This module covers the skills and techniques required to manage and system administer computers in a wide range of environments. Topics covered include common tasks, network-oriented administration, hardware and maintenance.

3D Animation

This module introduces you to the principles, algorithms, and techniques of 3D computer animation. You will undertake both theoretical

study of 3D computer animation, and practical animation techniques using industry standard applications and languages.

3D Graphics

This module introduces you to the theories, algorithms, and applications of 3D computer graphics. You will undertake both theoretical study of 3D graphics, and practical 3D graphics programming skills using the industry-standard graphics API for embedded accelerated 3D graphics – OpenGL ES – for application development on embedded systems including game consoles, phones (eg iPhone), appliances and vehicles.

ASSOCIATED CAREERS

Graduates will typically be part of a team working on sophisticated n-tier applications, as a designer, programmer, systems administrator or systems analyst (among others). Graduates will also find positions within new and established businesses that specialise in mobile applications. Other roles are possible in computer science research for either a commercial enterprise or academic institution. Further PhD study opportunities within the University of Westminster are also an option.

ENTRY REQUIREMENTS

You will normally have a good honours degree in a subject related to computer science from a UK university, or equivalent qualification. Suitable subjects might include computing, computer science or software engineering, joint degrees including one of these subjects, or possibly other science or maths-based subjects that include significant amounts of computer science material. If your first language is not English, and you have not had your secondary or tertiary education in English, you will need an IELTS score of at least 6.5. It's important that you will be able to complete the course and benefit from it, so other factors such as continuous professional development, training and your current role may also be taken into account.

RELATED COURSES

- Software Engineering MSc



SOFTWARE ENGINEERING MSc

Length of course

One year, full-time or two to five years, part-time

Location

Central London (Cavendish)

Fees and funding

See westminster.ac.uk/fees

Software engineering is the area of computing that is concerned with applying engineering-style methods to the production of computer software. It is a dynamic and expanding field that continues to play a central role in the UK's future economic growth. The continuing shortage of qualified software engineers means that graduates have been very successful in gaining software-related jobs by integrating their existing and newly acquired skills.

The course is aimed at software developers and programmers. The course's main theme is software development using the object-oriented paradigm. If you do not have a formal computing background, this course will give you greater skills and understanding of the development of software applications, from initial requirements through to implementation, with an emphasis on programming. Alternatively, if you do have a significant background in software engineering, the course will enable you to build on your existing knowledge.

You will benefit from a broad and varied array of state-of-the-art technologies, including:

- Sunray servers connected to a 1GB fibre optic network with links to both the Super-Janet 4 network and the London Metropolitan Network, connecting the Greater London education and research community
- a Uni-Backbone network that supports IP Multicasts to deliver a constant stream of interactive, multimedia-rich content
- over 20 laboratories providing access to Unix, Novell and NT servers, all supported by high-bandwidth networks
- specialist technicians to ensure you can get the most out of these technologies.

COURSE CONTENT

The core modules focus on the stages of the object-oriented software life cycle, from requirements analysis and capture to software design, software implementation of a design, software testing techniques, software system integration, and ending with software maintenance. The option modules offer you the opportunity to apply and extend these core skills in a variety of software application areas, including mobile devices, databases, enterprise development and system administration. You will complete a software development project that requires the application of the knowledge and skills taught on the course, as well as providing an opportunity to acquire new skills and knowledge. You will also gain extensive experience of many of the software tools and environments used in the software development industry.

A variety of teaching methods are used, ranging from formal lectures, problem-solving tutorials and programming laboratory sessions, to student presentations, student-led seminars and group work activities. By the end of the course, you will have the knowledge and skills required to be a professional practitioner in object-oriented software development and software engineering, and hence, to become a successful member of the IT industry.

CORE MODULES

Algorithmics

This module will give you the skills and theoretical knowledge to design and analyse algorithms in terms of their computational



complexity. You will cover the general techniques of algorithm design, with illustrations from system and end-user application areas, and an emphasis on the design and analysis of alternative algorithmic solutions to practical problems. Other topics you will cover include types of algorithm, time and space complexity, and the use of standard libraries.

Object-Oriented Programming

This module introduces you to the features of an object-oriented programming language (C++), and then uses this to demonstrate program development using the object-oriented paradigm. The topics covered include core language features, problem solving, object-oriented paradigm and the development of libraries.

Research Methods

The module aims to develop your knowledge and competence of the research process, and the application of research methods in the area of software engineering. The topics you will cover include research methods, strategies and paradigms, as well as supporting skills and professional issues relating to a career in software engineering. You will undertake a literature review, critical reading of research papers and the writing and presentation of a research proposal.

Software Design

You will examine the techniques and methods appropriate for the development of object-oriented software. You will explore the conceptual foundations of the object-oriented approach, and acquire practical skills in object-oriented design, and in the implementation of such designs. The main topics you will cover include unified modelling language (UML), data modelling, behavioural modelling, design and implementation.

Software Development (Project)

You will undertake an extended, individual piece of work on an approved topic, which unifies and extends your theoretical and practical knowledge of software engineering by applying them to develop a software application. A supervisor will provide you with guidance on planning, development, documentation and demonstration.

Software Engineering Context

You will examine the nature of software engineering and important external factors that influence the work of a practising software engineer. In particular you will explore software engineering life cycles, requirements engineering, user-interface design, software quality assurance, testing, and selected professional issues.

OPTION MODULES – you may choose two from the following:

Database Languages

Through this module you will discuss in detail the features and constructs of the SQL, the de-facto database language for the definition and manipulation of relational-data constructs. The module also covers procedural aspects of the language and issues related to the efficient use of and client/server programming constructs. The module is a hands-on skills module; the exercises and materials used in the delivery of the module are based on Oracle University materials, and you will have access to Oracle courseware that can help you with your preparation for Oracle Certification exams.

Enterprise Application Development

This module introduces you to the development of a distributed application within a contemporary software framework such as .NET and J2EE. You will examine the underlying principles and apply them to the development of typical n-tier application. You will consider both stationary and mobile applications will be considered. Other topics covered include: enterprise development frameworks, client, business, repository layers and MVC design pattern, event-driven programming, GUI applications, storage and file handling, database access, and web services.

iPhone Application Development

You will gain the necessary knowledge and practical experience to develop applications for native platforms through this module. It will give you the skills to produce applications that take advantage of the underlying hardware features of contemporary mobile devices, such as smartphones and multi-touch surfaces, location features, and natural gesturing through combination of accelerator and touch surfaces.

Mobile Application Development

This module covers mobile development approaches, application development technology for mobile devices including Java-enabled devices, the Android platform, the J2ME platform, and object-oriented programming.

Systems Administration

This module covers the skills and techniques required to manage and system administer computers in a wide range of environments. Topics covered include common tasks, network-oriented administration, hardware and maintenance.

ASSOCIATED CAREERS

Graduates are employed in a wide variety of roles related to software development, including internet programmer, programmer, software designer, systems administrator and web application programmer. The common theme of these roles is the need to understand and apply techniques related to the stages of the software life cycle process. Some graduates also go on to undertake a research degree related to the object-oriented paradigm.

ENTRY REQUIREMENTS

You will normally have a good first degree (at least a Lower Second). This may contain a significant amount of computing or software engineering, and you may wish to reinforce and build on your existing knowledge. Alternatively, this may be in a subject not containing a significant amount of computing or software engineering, in which case you will be expected to demonstrate prior interest in, or aptitude for, programming and working with computers. Under exceptional circumstances, if you do not have a degree, you may be considered if you have extensive professional experience of programming and software engineering.

If your first language is not English you will need an IELTS score of 6.5 or equivalent. If you satisfy the basic academic entry requirements you are invited to one of the University's open evenings, where you can meet the course leader and discuss any issues regarding the course.

RELATED COURSES

- Computer Science MSc

COMPUTER NETWORKS MSc

Length of course

One year, full-time or two to three years, part-time, block mode

Location

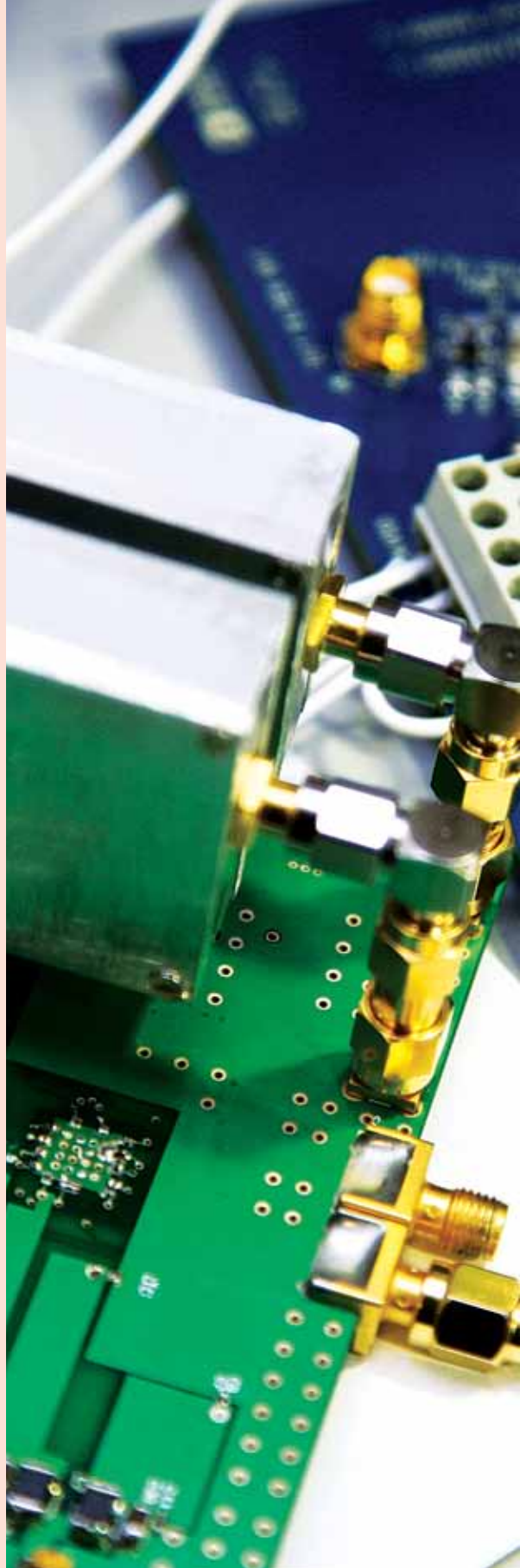
Central London (Cavendish)

Fees and funding

See westminster.ac.uk/fees

The unprecedented growth in commercial and information management uses of the internet and world wide web is only the visible tip of the vast scientific, computing, technical and engineering developments that are occurring in the field. As a result of this growth, new computer science and engineering disciplines must emerge. The programming techniques and technological requirements of this rapidly developing field are new territory, not only for those who have worked in this sector for some time, but also to many recent computer science graduates.

There is now a long-term and growing market for professionals possessing a clear overview of current information and communication networks capabilities, standards and trends, along with a firm grasp of specifics in areas ranging from data network protocols to network security issues. Whatever developments occur, there will always be a need for the designer and engineer who has knowledge and experience of both the engineering and implementation of a distributed or network system, and the ability to work at the higher levels of abstraction and programming of networked and distributed computing. As a graduate of this course, you will have the knowledge and skills to meet those needs.



COURSE CONTENT

We have a network laboratory for the design and evaluation of computer network architectures, an FPGA (Field Programmable Gate Array) laboratory for the latest chip creation technology, and an embedded systems laboratory for the development of systems using microcontrollers, digital signal processors and general-purpose microprocessors. These facilities are for the exclusive use of students and staff, providing resources that are among the best in the country.

You will be able to use up-to-date learning resources including a well-stocked library with traditional and electronic media, general-purpose network computing facilities, and dedicated laboratories which provide for activities ranging from program development to operating system configuration and communication system experimentation.

CORE MODULES

Communication and Computer Networks

You will gain an in-depth understanding of the infrastructure of computer networks in terms of design, logical organisation, protocol structures and physical interconnections. This module gives you a theoretical and practical insight into the fixed broadband communication networks, and reviews the most important broadband technologies.

Individual Project

This module is in two parts. The first covers the preparation and initial stages of your individual project, solving a problem relevant to your course of study. It strengthens your skills for the research and/or industry needs of the final project and covers critical evaluation, gathering and analysing of relevant information. The second part builds on the project specification and plan, giving you the opportunity to show your individual creativity and originality, and develop, enhance and promote your problem definition, analysis, critical evaluation, presentation and communication skills, as well as applying your knowledge and skills gained through the course.

Network Configuration and Operation

This module gives you an insight into the design and development of networks in the real world, and employs a contemporary network operating system to facilitate this. It also introduces the idea of using tools to allow an easy means of network problem diagnosis.

Network Programming

You will cover the principles of network programming and relevant software development methodologies and tools. To do this, an appropriate programming language is introduced, emphasising the design and implementation of socket level network programs.

OPTION MODULES

Broadband Wireless Networks

You will gain a theoretical insight into broadband wireless communication from a network point of view, along with a thorough understanding of the principles, technologies and the state-of-the-art of the wireless communication networks. The module aims to familiarise you with the latest development of wireless communication network systems and the different approaches that are used in their analysis, and enable you to understand application in systems such as LTE, WLAN, WPAN, Point-to-point wireless links, and Fixed/Mobile WiMAX.

Cellular Wireless Networks

This module provides you with an up-to-date knowledge of new technologies in cellular radio communication systems, and covers both the basic and more advanced topics in this area. Your programme of study will include the fundamental principles of mobile cellular systems design and engineering, and provides an understanding of the evolution of the existing and future generations of digital technologies of public land mobile networks, such as 2G GSM/GPRS, 3G UMTS, and 4G LTE. The syllabus covers key areas including physical layer functions, multiple access technologies, cellular systems, multipath fading, mobility management, and wireless security.



Communication Principles

This module enhances the skills you need for the analysis of signals and systems, and introduces the key concepts and functional building blocks of digital communication systems. Topics include the Fourier transform and convolution, energy and power spectral densities of deterministic and random signals, sampling and baseband signaling, digital modulation schemes, spread-spectrum systems, and channel coding.

Distributed Systems

This module introduces you to the principles and concepts underlying distributed systems, with particular attention paid to the fundamentals of synchronisation, concurrency and replication. You will analyse the way these fundamentals relate to common aspects of distributed systems such as naming, consistency and fault tolerance. Modern software platforms used to support the design and development of distributed systems are compared and employed in laboratory work, and case studies of complete distributed systems are used to illustrate and reinforce all the concepts and principles.

Network Modelling and Simulation

You will develop your understanding of network modelling and simulation methodology for modern computer networks, from the viewpoints of both system users and network designers. Common problems and

ways to avoid them are presented through evaluation and analysis of experimental case studies using modelling and simulation techniques. These include overall system performance and computer network planning.

Network Security

This module introduces you to the techniques to secure computer networks, and critically evaluates them in the light of a variety of types of attacks. The topics you will cover include network security concepts, computer and network system attacks, cryptography, web security, wireless security, network security tools, and systems. During the practical sessions, you will use an isolated computer laboratory to explore a range of software tools available to audit vulnerabilities in networks and to configure security.

ASSOCIATED CAREERS

The course emphasises the underlying concepts and operating principles of networked systems and their programming, giving you access to a wide range of careers centred on computer networks. Some former graduates are self-employed, while others belong to large organisations in the public and the private sectors.

ENTRY REQUIREMENTS

You should have qualifications equivalent to a good Honours degree from a UK university in computer engineering, computer science with a knowledge of computer hardware, or in electronic engineering with some programming experience. Relevant work experience will be taken into account. An IELTS score of 6.5 or equivalent will normally be required from applicants whose first language is not English, or who have not studied their secondary and bachelor's degree education in English.

RELATED COURSES

- Embedded Systems MSc
- Microelectronic System Design MSc
- Mobile, Wireless and Broadband Communications MSc



EMBEDDED SYSTEMS MSc

Length of course

One-year, full time or two to three years, part-time, block mode

Location

Central London (Cavendish)

Fees and funding

See westminster.ac.uk/fees

The demand for embedded system engineers in all areas of engineering is flourishing, as embedded systems find yet more applications in everyday life. All electronic and software products are now embedded systems, with everyday examples including digital cameras, media players, ATM machines and robotic surveillance tools. These applications require a high level of skill in hardware and software engineering and an understanding of the practical realities of real systems. They also require knowledge in specialist subjects including Digital Signal Processing (DSP), communications, mechatronics and requirements engineering.

Many companies need engineers with good software and hardware skills, and demand continues to increase as electronics, communications, and media (including television, radio and still image) systems have converged. Despite this growing demand, there is a shortage of good embedded system engineers, as most UK undergraduate courses currently do not produce such people.

COURSE CONTENT

This course will equip you with the key skills required to work with embedded systems, including real-time operating systems and microcontrollers. It will also develop your knowledge and practical experience of media processors, and give you the opportunity to study specialised option modules.

We have a network laboratory for the design and evaluation of computer network architectures, an FPGA (Field Programmable Gate Array) laboratory for the latest chip creation technology, and an embedded systems laboratory for the development of systems using microcontrollers, digital signal processors and general-purpose microprocessors. These facilities are for the exclusive use of students and staff, providing resources that are among the best in the country.

You will develop your key transferable skills through a variety of teaching methods, including presentations, technical discussions, project work and formal reports, as well as group and one-to-one tutorials and lectures. Engineering problem-solving skills are enhanced through the use of software for all aspects of design, documentation and testing of hardware.

CORE MODULES

Embedded System Design

This module develops your skills in prototyping and specifying the requirements of practical standalone embedded systems to final implementation. You will critically evaluate design choices and examine the practical limitations of real-world components. Various prototyping methodologies and platforms are demonstrated and explored via group-based laboratory sessions and lectures. You will also explore the future trends, emerging technologies and applications of these systems.

Individual Project

This module is in two parts. The first covers the preparation and initial stages of your individual project, solving a problem relevant to your course of study. It strengthens your skills for the research and/or industry

needs of the final project and covers critical evaluation, gathering and analysing of relevant information. The second part builds on the project specification and plan, giving you the opportunity to show your individual creativity and originality, and develop, enhance and promote your problem definition, analysis, critical evaluation, presentation and communication skills, as well as applying your knowledge and skills gained through the course.

Integrated Digital Systems Design

This module introduces you to the methodology and techniques required for the 'right first time' design of digital integrated circuits. It will impart confidence in your to design custom chips targeted to FPGA and standard cell implementations, and build up familiarity with design tools at various levels of the IC design process including schematic capture, HDL definition, logic synthesis and design verification.

Real-Time Environments

This module aims to introduce and explore aspects of operating systems and programming languages essential to real-time and embedded systems. It will also provide you with a stronger understanding of practical engineering issues raised by the specification, design and implementation of real-time embedded systems.

OPTION MODULES

– choose three from:

DSP and Communication Processor Design

This module introduces you to implementations of dedicated algorithms for signal and data processing structures. It develops your understanding of design techniques and approaches for high-speed area and power efficient computational and arithmetic architectures, and creates awareness for algorithm, circuit and architecture trade-offs, as well as introducing you to arithmetic and number representation standards.

DSP Design and Applications

You will gain a comprehensive grounding in the theory of digital signal processing,

establishing a broad body of theory and analysis approaches that utilise discrete-time formulations and a variety of transforms. The module gives you particular insight into digital filters of both FIR and IIR types, with design experience focused on FIR filters. Deterministic processing is augmented by stochastic principles to facilitate treatment of tone detection topics.

Embedded Media Processing

This module gives you a comprehensive understanding and practical experience in the application of specialist processors and specialist bus interfaces for media processing. You will examine the architectures of DSP and media processors, and develop critical awareness of their characteristics. Example media processing algorithms, file formats, interfaces, and digital signal processing (DSP) implementations are also given.

Multirate Signal Processing

This module provides you with in-depth experience across a range of iterative and

matrix-based design techniques that are central to modern FIR and IIR digital filter design. The theory of multirate systems is developed, moving treatment from a deterministic standpoint to a stochastic thrust centred on cyclostationary concepts. Illustrations of detection in noise underline the important role matched filters play in modern digital signal processing.

SoC and FPGA Design Project

This module gives you experience in the top-down development of integrated circuits, enabling you to implement design-for-test (DfT) procedures and use CAE hierarchical design tools. It will also give you more experience in producing synthesisable VHDL code, providing a practical understanding of the rigours of a modern design methodology.

Video and Image Processing

You will gain a working knowledge of a broad range of video and image processing, including pattern recognition, morphology, texture analysis compression, segmentation, classification, machine vision tasks and watermarking.

ASSOCIATED CAREERS

Graduates will typically find employment in the broadcasting, multimedia, internet, science, instrumentation, robotics, surveillance, medical and communications industries.

ENTRY REQUIREMENTS

You should have qualifications equivalent to a good Honours degree from a UK university in computer engineering, computer science with a knowledge of computer hardware, or in electronic engineering with some programming experience. Relevant work experience will be taken into account. If your first language is not English you will need an IELTS score of 6.5 or equivalent.

RELATED COURSES

- Computer Networks MSc
- Microelectronic System Design MSc
- Mobile, Wireless and Broadband Communications MSc



MICROELECTRONIC SYSTEM DESIGN MSc

Length of course

One year, full-time or two to three years, part-time, block mode

Location

Central London (Cavendish)

Fees and funding

See westminster.ac.uk/fees

The breathtaking advances in the field of microelectronics over the past 20 years has made the implementations and realisations of real-time fast and power-efficient computer systems, digital signal processing (DSP) systems, communication systems, biomedical systems and systems for consumer goods a reality. Circuit complexities of millions of transistors are now common, and advances in silicon processing and geometry reduction are set to continue for many years to come.

To be able to take advantage of these advances in microelectronic technology, there will always be a need for suitably qualified engineers with experience and know-how of the latest technological developments, and the tools to support them. This course aims to give you the skills and knowledge to make a worthy contribution in the VLSI and microelectronic industry, where the outlook remains optimistic despite the problems in the world economy.



COURSE CONTENT

The delivery of the technical content benefits from the experience of our teaching teams, who are involved in cutting-edge industrial research and development work. The course provides a breadth of view, and experience of implementation details via suitably selected real-life problem-solving, project and simulation work.

We also have a network laboratory for the design and evaluation of computer network architectures, an FPGA (Field Programmable Gate Array) laboratory for the latest chip creation technology, and an embedded systems laboratory for the development of systems using microcontrollers, digital signal processors and general-purpose microprocessors. These facilities are for the exclusive use of students and staff, providing resources that are among the best in the country.

CORE MODULES

Individual Project

This module is in two parts. The first covers the preparation and initial stages of your individual project, solving a problem relevant to your course of study. It strengthens your skills for the research and/or industry needs of the final project and covers critical evaluation, gathering and analysing of relevant information. The second part builds on the project specification and plan, giving you the opportunity to show your individual creativity and originality, and develop, enhance and promote your problem definition, analysis, critical evaluation, presentation and communication skills, as well as applying your knowledge and skills gained through the course.

Integrated Digital Systems Design

This module introduces you to the methodology and techniques required for the 'right first time' design of digital integrated circuits. It will impart confidence in your ability to design custom chips targeted to FPGA and standard cell implementations, and build up familiarity with design tools at various levels of the IC design process including schematic capture, HDL definition, logic synthesis and design verification.

Microelectronic Circuit Design

This module introduces custom design of digital circuits in the MOS medium (primarily CMOS). It will enable you to develop your appreciation of device fabrication and the factors which affect device and circuit performance, including issues related to sub-micron technologies. The module also makes you familiar with a range of CAE software packages for design and simulation of MOS circuits, at the device and layout levels of abstraction.

SoC and FPGA Design Project

This module gives you experience in the top-down development of integrated circuits, enabling you to implement design-for-test (DfT) procedures and use CAE hierarchical design tools. It will also give you more experience in producing synthesisable VHDL code, providing a practical understanding of the rigours of a modern design methodology.

OPTION MODULES

– choose three from:

DSP and Communication Processor Design

This module introduces you to implementations of dedicated algorithms for signal and data processing structures. It develops your understanding of design techniques and approaches for high-speed area and power efficient computational and arithmetic architectures, and creates awareness for algorithm, circuit and architecture trade-offs, as well as introducing you to arithmetic and number representation standards.

DSP Design and Applications

You will gain a comprehensive grounding in the theory of digital signal processing, establishing a broad body of theory and analysis approaches that utilise discrete-time formulations and a variety of transforms. The module gives you particular insight into digital filters of both FIR and IIR types, with design experience focused on FIR filters. Deterministic processing is augmented by stochastic principles to facilitate treatment of tone detection topics.



Embedded Media Processing

This module gives you a comprehensive understanding and practical experience in the application of specialist processors and specialist bus interfaces for media processing. You will examine the architectures of DSP and media processors, and develop critical awareness of their characteristics. Example media processing algorithms, file formats, interfaces, and digital signal processing (DSP) implementations are also given.

Embedded System Design

This module develops your skills in prototyping and specifying the requirements of practical standalone embedded systems to final implementation. You will critically evaluate design choices and examine the practical limitations of real-world components. Various prototyping methodologies and platforms are demonstrated and explored via group-based laboratory sessions and lectures. You will also explore the future trends, emerging technologies and applications of these systems.

Multirate Signal Processing

This module provides you with in-depth experience across a range of iterative and matrix-based design techniques that are central to modern FIR and IIR digital filter design. The theory of multirate systems

is developed, moving treatment from a deterministic standpoint to a stochastic thrust centred on cyclostationary concepts. Illustrations of detection in noise underline the important role matched filters play in modern digital signal processing.

Real-Time Environments

This module aims to introduce and explore aspects of operating systems and programming languages essential to real-time and embedded systems. It will also provide you with a stronger understanding of practical engineering issues raised by the specification, design and implementation of real-time embedded systems.

Video and Image Processing

You will gain a working knowledge of a broad range of video and image processing, including pattern recognition, morphology, texture analysis compression, segmentation, classification, machine vision tasks and watermarking.

ASSOCIATED CAREERS

This course will enable you to become a valuable engineer in the fast-moving broadband communications and IT industry. The main emphasis is to merge broadband communication and information networks. You will therefore benefit from the wide choice of career opportunities that are currently growing in these market sectors.

ENTRY REQUIREMENTS

You should have qualifications equivalent to a good Honours degree from a UK university in electronic engineering or a good Honours degree in computer science, mathematics or other technological subject, with a knowledge of mathematics and digital systems. Relevant work experience will be taken into account. If your first language is not English, you will need an IELTS score of 6.5 or equivalent.

RELATED COURSES

- Computer Networks MSc
- Embedded Systems MSc
- Mobile, Wireless and Broadband Communications MSc



MOBILE, WIRELESS AND BROADBAND COMMUNICATIONS MSc

Length of course

One year, full-time or two to three years, part-time, block mode

Location

Central London (Cavendish)

Fees and funding

See westminster.ac.uk/fees

The demand for engineers in both wide-area and local-area communication networks is currently flourishing, and is expected to continue growing as multimedia data transmissions find more applications in everyday life. The latest communications standards have been hugely influential in accelerating dissemination of mobile telephony, internet-on-the-move, video and audio streaming and mobile computing. They have achieved truly compatible international communications for everyone, and society is displaying a voracious appetite for communications on a scale that surpasses even the most optimistic projections of a few short years ago.

The expansion of communications companies is prodigious. While most of the headlines focus on large corporate entities, there is a strong upsurge of small and medium enterprises devoted to niche products and services fuelling the communications machine. This has led to a colossal demand for engineers skilled in these emerging communications technologies, and has shaped this MSc. There is now a long-term and growing market for graduates possessing a clear overview of current communications capabilities in both cellular and broadband wireless networks. This course sets out to give you just such a breadth of view, and press home experience of implementation details via problem-solving, project and simulation work.

We also have a network laboratory for the design and evaluation of computer network architectures, an FPGA (Field Programmable Gate Array) laboratory for the latest chip creation technology, and an embedded systems laboratory for the development of systems using microcontrollers, digital signal processors and general-purpose microprocessors. These facilities are for the exclusive use of students and staff, providing resources that are among the best in the country.

COURSE CONTENT

The core modules build on the fundamental methods in digital communications, to cover the latest technologies in cellular networks, high-speed wired networks and broadband local-area networks. Option modules enable you to study further communication and networking topics, or the enabling technologies of embedded computer systems, microelectronic design and digital signal processing. Projects will be carefully chosen to integrate your interest either with the active research thrust within electronics, or with relevant activity in your own workplace.

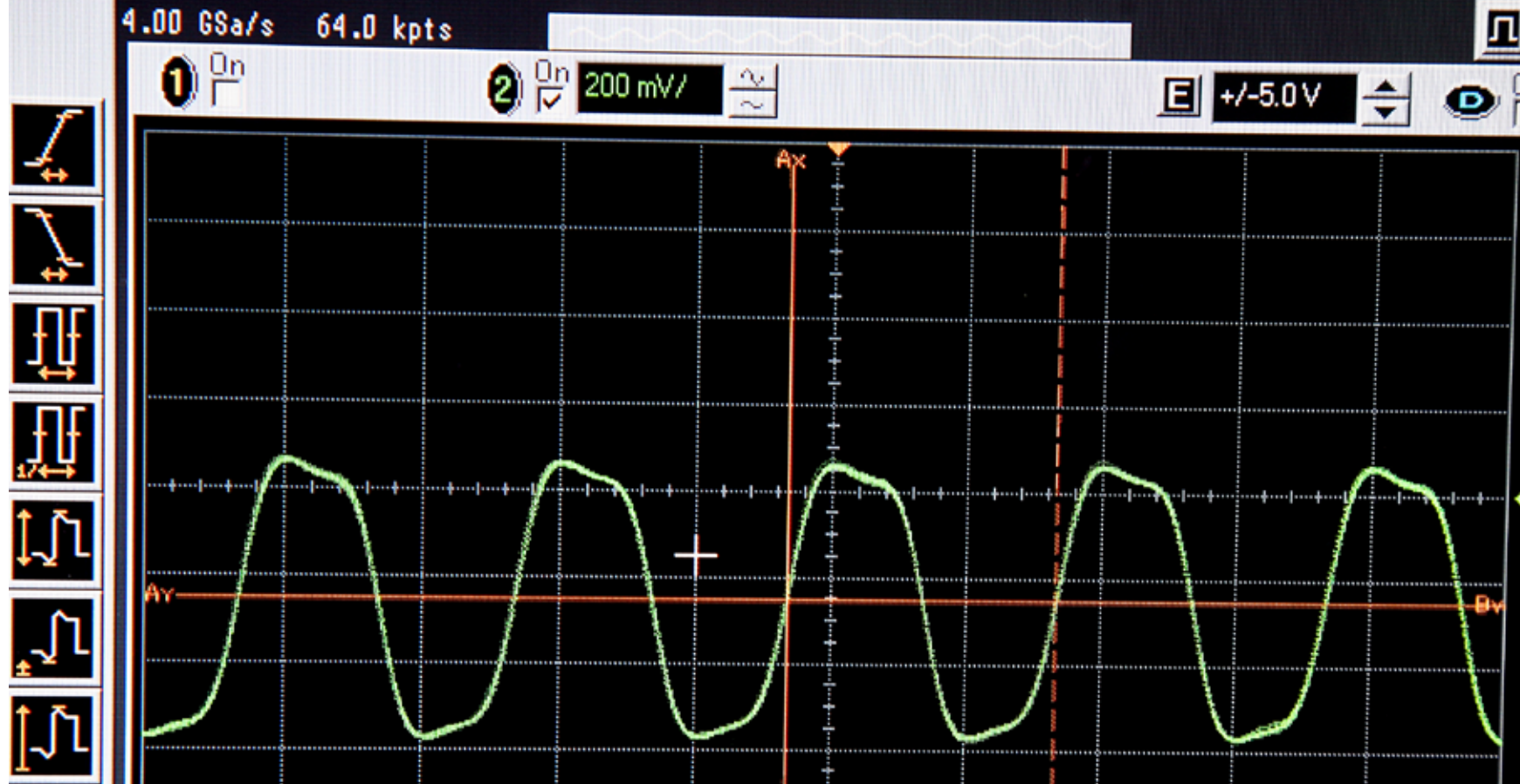
CORE MODULES

Broadband Wireless Networks

You will gain a theoretical insight into broadband wireless communication from a network point of view, along with a thorough understanding of the principles, technologies and the state-of-the-art of the wireless communication networks. The module aims to familiarise you with the latest development of wireless communication network systems and the different approaches that are used in their analysis, and enable you to understand application in systems such as LTE, WLAN, WPAN, Point-to-point wireless links, and Fixed/Mobile WiMAX.

Cellular Wireless Networks

This module provides you with an up-to-date knowledge of new technologies in cellular radio communication systems, and covers both the basic and more advanced topics in this area. Your programme of study will include the fundamental principles of mobile cellular systems design and engineering, and



provides an understanding of the evolution of the existing and future generations of digital technologies of public land mobile networks, such as 2G GSM/GPRS, 3G UMTS, and 4G LTE. The syllabus covers key areas including physical layer functions, multiple access technologies, cellular systems, multipath fading, mobility management, and wireless security.

Communication and Computer Networks

You will gain an in-depth understanding of the infrastructure of computer networks in terms of design, logical organisation, protocol structures and physical interconnections. This module gives you a theoretical and practical insight into the fixed broadband communication networks, and reviews the most important broadband technologies.

Communication Principles

This module enhances the skills you need for the analysis of signals and systems, and introduces the key concepts and functional

building blocks of digital communication systems. Topics include the Fourier transform and convolution, energy and power spectral densities of deterministic and random signals, sampling and baseband signaling, digital modulation schemes, spread-spectrum systems, and channel coding.

Individual Project

This module is in two parts. The first covers the preparation and initial stages of your individual project, solving a problem relevant to your course of study. It strengthens your skills for the research and/or industry needs of the final project and covers critical evaluation, gathering and analysing of relevant information. The second part builds on the project specification and plan, giving you the opportunity to show your individual creativity and originality, and develop, enhance and promote your problem definition, analysis, critical evaluation, presentation and communication skills, as well as applying your knowledge and skills gained through the course.

OPTION MODULES

– choose three from:

DSP Design and Applications

You will gain a comprehensive grounding in the theory of digital signal processing, establishing a broad body of theory and analysis approaches that utilise discrete-time formulations and a variety of transforms. The module gives you particular insight into digital filters of both FIR and IIR types, with design experience focused on FIR filters. Deterministic processing is augmented by stochastic principles to facilitate treatment of tone detection topics.

Embedded System Design

This module develops your skills in prototyping and specifying the requirements of practical standalone embedded systems to final implementation. You will critically evaluate design choices and examine the practical limitations of real-world components. Various prototyping methodologies and platforms are demonstrated and explored via group-based laboratory sessions and lectures.

You will also explore the future trends, emerging technologies and applications of these systems.

Multirate Signal Processing

This module provides you with in-depth experience across a range of iterative and matrix-based design techniques that are central to modern FIR and IIR digital filter design. The theory of multirate systems is developed, moving treatment from a deterministic standpoint to a stochastic thrust centred on cyclostationary concepts. Illustrations of detection in noise underline the important role matched filters play in modern digital signal processing.

Network Modelling and Simulation

You will develop your understanding of network modelling and simulation methodology for modern computer networks, from the viewpoints of both system users and network designers. Common problems and ways to avoid them are presented through evaluation and analysis of experimental case studies using modelling and simulation techniques. These include overall system performance and computer network planning.

Network Security

This module introduces the techniques to secure computer networks and critically evaluates them in the light of a variety of types of attacks. Topics you will cover include network security concepts, computer and network system attacks, cryptography, web security, wireless security, network security tools, and systems. During the practical sessions, an isolated computer laboratory will be used to explore a range of software tools available to audit vulnerabilities in networks and to configure security.

Real-Time Environments

This module aims to introduce and explore aspects of operating systems and programming languages essential to real-time and embedded systems. It will also provide you with a stronger understanding of practical engineering issues raised by the specification, design and implementation of real-time embedded systems.

Wireless System Design

You will gain a theoretical insight into the advanced design of wireless circuits, subsystems and systems, and a thorough understanding of the principles, technologies and the state-of-the-art of the wireless system design. The module will familiarise you with the latest development of wireless system design, and the different approaches that are used in their analysis. It gives you the background to be able to analyse other wireless system circuits such as RF and microwave filters, amplifiers and antennas for mobile radio communications, fixed/mobile broadband wireless communications, satellite communications, Point-to-point microwave radio links, and Fixed/Mobile WiMAX.

ASSOCIATED CAREERS

The course is suitable for engineering and science graduates interested in specialising in this flourishing area. It has been particularly tailored to suit engineers from industry who are either already working in the field, or are likely to be involved in related projects in the future.

ENTRY REQUIREMENTS

The required qualification is equivalent to a good Honours degree from a UK university in electronic engineering or a good Honours degree in computer science, mathematics or other technological subject with a knowledge of mathematics and signal processing. Relevant work experience will be taken into account. If your first language is not English you will need an IELTS score of 6.5 or equivalent.



MULTIMEDIA MSc

Length of course

One-year, full time or two to three years, part-time, block mode

Location

Central London (Cavendish)

Fees and funding

See westminster.ac.uk/fees

This course has been designed to produce 'hands on' professionals with a broad range of career possibilities in the multimedia industry, either working as multimedia designers/producers, or as part of a development team. This sector is expanding rapidly in all areas, and a report by Forrester Research in 2008 predicted that the Web 2.0 Social Media market will be generating revenues of \$4.4 billion by 2013. Other reports estimate that companies will spend \$120 billion in 2010 on online and digital strategies (search engines to videos) in the USA alone.

The course has been designed to address the needs of these emerging areas, and ensure graduates can adapt to the changing needs of the sector. We have excellent links within the multimedia industry, and many companies and experts have visited the School in previous years to give presentations, including MPC, Sky, Apple and Adobe as well as companies looking to recruit students after finishing the Masters. The Multimedia MSc hosts multimediatrainingvideos.com, a comprehensive repository of freely accessible multimedia training videos to which the teaching team have been significant contributors to the site over the last few years. This site has become one of the biggest Open Educational Resources (OER) sites for multimedia on the internet and was funded by JISC.

COURSE CONTENT

The course emphasises the key multimedia principles, theories and concepts, as well as exposing you to the industry standard languages and tools including Flash, HTML, AJAX, After Effects and Xcode. You will examine a number of areas, including human computer interaction and the user experience, project management, web development, scripting for interactivity, and analytics. The course will enable you to develop the knowledge and skills required in a number of careers as well as preparation to continue to a PhD.

CORE MODULES

Multimedia Management

This module gives you a broad understanding of the planning and organisation that goes into developing a product. You will work with a real client, taking the process right through from an initial meeting to the execution of a prototype, providing you with practice in many of the key tools and concepts used in project management.

Multimedia Scripting for Interactivity

You will develop and implement an interactive application, using an industry-standard development environment and object-oriented scripting language. You will organise and plan the production of the prototype, with an emphasis on the approach taken to coding.

Project

The project is an extended piece of supervised independent work relevant to the field. This can be either undertaken as a work-based project or on a topic proposed by the student or faculty.

Research Methods and Professional Practice

You will strengthen your skills for the research and industry needs of the course, the final project, and for your future career and study. The module guides your personal development plan towards the professional requirements of the discipline, and covers methods of critical evaluation, gathering and analysing information, and preparing and defending a project proposal.

User-Centred Interface Design

The module will explore the foundations of user-centred interface design and the user experience through applied theory. You will be introduced to the importance of the Human Computer Interaction discipline, and the need to consider both the cognitive and interaction perspective. Building from this you will explore related issues such as design, interaction, globalisation, accessibility and navigation.

OPTION MODULES

Digital Editing and Motion Graphics

You will explore areas related to the creation of motion graphics, and gain an overview of non-linear editing techniques using industry standard tools from Adobe and Apple.

iPhone Application Development

You will gain the necessary knowledge and practical experience to develop applications for native platforms through this module. It will give you the skills to produce applications that take advantage of the underlying hardware features of contemporary mobile devices, such as smartphones and multi-touch surfaces, location features, and natural gesturing through combination of accelerator and touch surfaces.

Mobile Application Development

The module gives consideration to the use of application development technology for Mobile devices including Java enabled devices and Android.

Pervasive Computing and Interactive Systems

The module is designed to give you a theoretical and practical background to the development of immersive environments for various platforms, using industry standard toolkits. You will focus particularly on the algorithms, theories and design of new digital media, and their application to multi-platform environments such as mobile interfaces, pervasive games, web applications and web logs (blogs), interactive installations, interactive museum guides, and virtual and augmented environments.



Web Development

You will focus on the foundations of modern web development languages and environments, with an emphasis on efficient client-side development as well as an overview of database connectivity. You will also focus on emerging standards including HTML5.

Web Marketing and Analytics

The module focuses on the fundamental concepts and strategies of web and digital marketing, and will develop your critical knowledge and skill of the current technologies and techniques used including SEO, analytics and Buzz Web 2.0 marketing.

3D Animation

This module introduces you to the principles, algorithms, and techniques of 3D computer animation. You will undertake both theoretical study of 3D computer animation, and practical animation techniques using industry standard applications and languages.

3D Graphics

This module introduces you to the theories, algorithms, and applications of 3D computer graphics. You will undertake both theoretical study of 3D graphics, and practical 3D graphics programming skills using the industry-standard graphics API for embedded accelerated 3D graphics – OpenGL ES – for application development on embedded systems including game consoles, phones (eg iPhone), appliances and vehicles.

You may also take another module from the postgraduate portfolio, at the course leader's discretion.

ASSOCIATED CAREERS

Graduates may find employment in multimedia production houses, corporate environments (marketing, communications, IT and training), educational institutions, the media and film industry, and in entertainment. Possible roles include multimedia authoring specialist, project/production manager, website developer, and usability designer. We have excellent links with the multimedia industry (particularly in education), and previous graduates have been employed by companies such as 2Simple, 20:20 Media, Moving Picture Company, Oxford University Press, and Tiscali. Successful graduates may also apply for a research degree in a relative area.

ENTRY REQUIREMENTS

The course is open to computer literate graduates with a good first degree (minimum Second Class Honours) or equivalent in a related discipline such as graphic design, computer science, digital imaging or journalism. Alternatively you may have in-depth work experience in a related field, or already be employed in the sector and are undertaking the programme to further enhance your career plans. The relevance of your first degree or industrial experience and suitability for the course will be usually determined by interview and, where relevant, portfolio. If English is not your first language, you will need an IELTS score of 6.5.



RESEARCH

There are many exciting opportunities to work within the research groups of the School of Electronics and Computer Science to obtain an MPhil or PhD either part-time or full-time. As a research student you will work within one of the School's research groups and make a critical investigation into new areas of computational systems engineering, semantic computing, electronics and communications engineering, healthcare informatics.

The research activities in our School concentrate in four research clusters:

- Electronic and Communication Engineering Research cluster
- Operational Research and Intelligent Systems cluster
- Parallel and Distributed Computing Research cluster
- Semantic Computing and System Engineering Research cluster.

Electronic and Communication Engineering Research cluster

Activities in this cluster address a variety of the daily needs of modern society. Our expert knowledge of cutting-edge signal processing techniques and design methodologies of power-efficient integrated circuits (VLSI) is deployed in areas such as global navigation satellite systems (eg GPS and Galileo), communication systems, biomedical equipment or aviation industry. We use our expertise in microwave systems to provide components, circuits and systems for the fourth generation communication systems. We engage in projects providing IT infrastructure to remotely support vulnerable members of the society including the elderly, people suffering from chronic diseases

“The learning curve at the initial stage of my research studies at the School of Electronics and Computer Science (ECS) was very steep. The constant help and encouragement of my supervisor and the ECS staff were crucial to the progress of my research, mainly in the early stages.

The wide spectrum of skills possessed by ECS staff members and their expertise in various fields of electronics systems is/was a key asset in terms of evaluating and validating my research from different perspectives. The rigorous and comprehensive training programmes offered to research students at ECS has equipped me with the skills needed to carry out high standard academic research.

This included attending taught courses, seminars and workshops along with the constant encouragement to participate in international as well as national conferences to be abreast of the latest breakthroughs in my field of research. My research experience at ECS as a PhD student has been invaluable and has undoubtedly widened my academic abilities.”

BASHAR AHMAD
FORMER PhD STUDENT

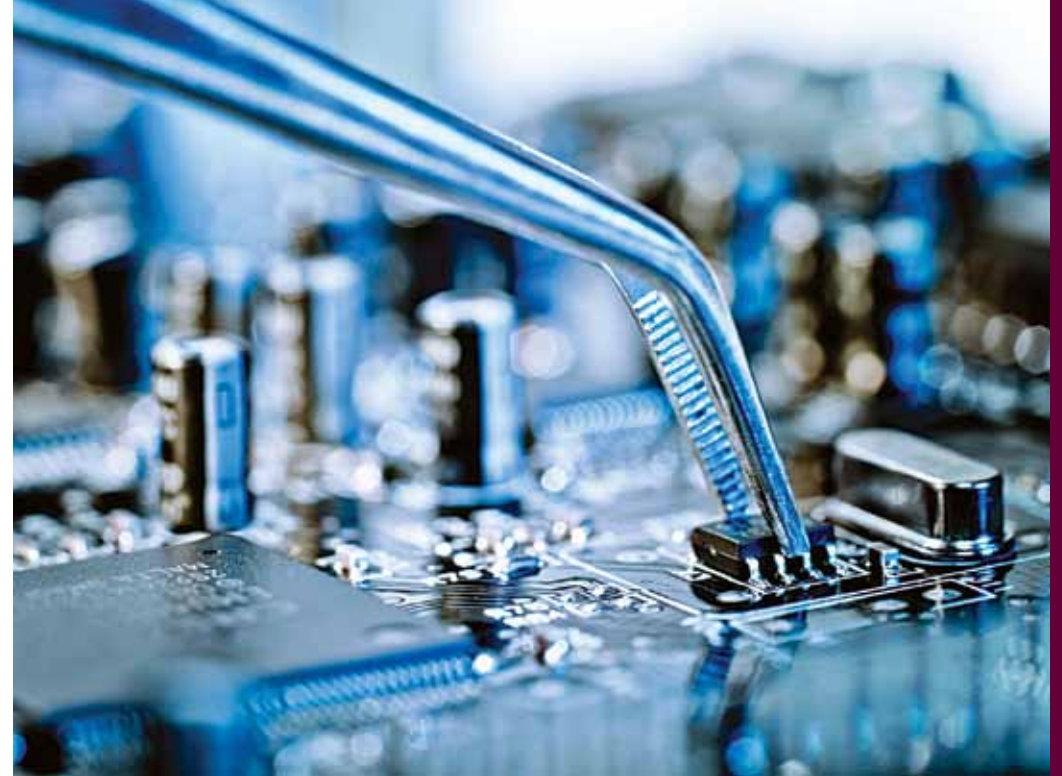
such as Parkinson’s or those with restricted mobility. A big part of our research is done in collaboration with other research institutions and industrial companies in the UK, Europe and around the world.

Operational Research and Intelligent Systems cluster

This cluster concentrates on quantitative modelling of complex systems in order to support decision-making processes, data and information management systems, database technology to management processes, and interoperability in pervasive software environments. The developed methodologies are applicable across a wide range of disciplines and industries. However our focus is on health and social care, whose needs are one of the main motivators for our research. Specialist topics include modelling of A&E, neonatal and geriatric services, development of decision support tools for monitoring clinical performance, estimating cost and length of stay in long-term care, modelling bed occupancy and length of stay development of business analysis applications. Our research is actively supported by healthcare organisations including the NHS, which also benefits from our specialist training short courses.

Parallel and Distributed Computing cluster

We focus our activities on research and development in the technology and application domains for parallel and distributed computations. With more than 30 academics, researchers, and PhD students the cluster provides a rich and dynamic environment with a large number of internal and external research contacts and collaborative projects. On a national and European level we have made a number of key contributions, with a long record of successful research grants and initiatives, while also contributing directly to the School’s postgraduate programmes. The cluster operates well-developed, state-of-the-art computing facilities and has been a partner site of the UK National Grid Service since 2006. Working at the highest levels of academic research and development underpins the integrity and impact of everything we do.



Semantic Computing and Systems Engineering (SCSE) cluster

Semantic computing, a rapidly evolving interdisciplinary field, seeks to leverage computer mediated forms of interactions (human-human, human-machine, machine-machine) and intelligence (computational, collective, ambient), in both real and virtual world environments. It seeks to advance and apply semantics-based computational methods and techniques in order to create a more meaningful interactive paradigm and user experience. The SCSE cluster includes researchers from different disciplines, such as software engineering and human-machine interaction, and addresses both the theoretical and practical aspects of semantic computing. Areas of particular interest are real-world applications (eg data integration and collaborative information systems, web, search engines, text analytics, software requirement analysis, software as service, video, speech and image contents analysis, interactive television, automated surveillance systems, gesture and face detection and recognition, affective computing, man-machine interfaces, and e-learning) and on virtual-world applications (eg social virtual environments, agents and avatars in metaverse, and games).

PhD and MPhil Programmes

We currently have over 50 students registered for MPhil and PhD degrees across all our disciplines, and over 200 Masters students, who benefit from state-of-the-art facilities and a thriving research environment.

Our research is supported by major grants and awards from government departments, research councils, the European Union and industry, and benefits from strong national and international links with leading academic and commercial organisations. We also offer services to industry such as consultancy, system development, seminars and professional training programmes, all linked to the educational portfolio of the School. To find out more about our current projects visit www.westminster.ac.uk/schools/computing/research/projects

If you are interested in conducting research with us contact:

Dr Andrzej Tarczynski
Director of Research and Knowledge Transfer
E: tarczyna@westminster.ac.uk



COURSE ENQUIRIES

Our Course Enquiries Team can provide you with information and advice on a range of issues, including:

- all course information and course outlines
- attendance
- associated careers
- campus tours – dates and times
- contact details of for Admissions Offices and Admissions Tutors
- entry requirements
- fees
- funding and bursaries
- how to apply
- IELTS tests – how and where to take them
- Postgraduate Information Evening – dates, times and locations
- prospectuses – how to order a printed copy
- qualifications
- scholarships
- non-UK qualifications equivalencies.

Call our dedicated course enquiries team between 9am-5pm, Monday - Friday.

T: +44 (0)20 7915 5511

E: course-enquiries@westminster.ac.uk

Course Enquiries Office

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Second Floor, Cavendish House
101 New Cavendish Street
London W1W 6XH

Information in this brochure is correct at the time of going to press but amendments may have to be made subsequently.

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MEET US IN YOUR COUNTRY

Members of the University frequently travel overseas to meet and interview potential students at exhibitions, partner institutions, alumni receptions and other events. We also work with representatives around the world who can help you with your application on our behalf. Visit westminster.ac.uk/international to see our calendar of visits and local representatives.