Faculty of Science and Technology

The Faculty of Science and Technology is a vibrant and active community of people with big ideas. We have innovative ways of teaching, new Masters degrees to help you build your career, a range of ways in which you can study for your doctorate, and new labs and buildings to work in.

This is built on the foundation of staff excellence in core scientific disciplines.

Our postgraduate community is international with over 40% of our 916 postgraduate students coming from overseas and the EU, and being taught by an international body of staff. You may wish to get involved with a range of partnerships at a European and global level and all postgraduate students will have the opportunity to interact with visiting international scholars.

Our research is world-class with 94% of the Faculty’s output categorised as international quality in the Research Assessment Exercise (RAE) 2008. The quality of our research is mirrored in the excellence of our teaching that will train you to address complex and important scientific problems and technological challenges.

During the last year, the Faculty has attracted more than £18m in research income. We have received grants from international organisations such as the European Commission, NATO and European Space Agency; from UK Government departments such as the DTI and DEFRA; UK research councils, national agencies (Environment Agency, Health and Safety Executive); as well as the Royal Society and British Academy, major medical funders and charities (NHS Executive, Wellcome Trust and NW Cancer Research Fund).

Our business partnerships provide postgraduate students with valuable opportunities to gain experience of working with a business while studying. Science and Technology staff have developed strong relationships with business to ensure that your learning is relevant and innovative. Major companies such as Unilever and BP have invested in our projects and supported our work and we have an established business partnership and enterprise programme across the faculty – over 2,250 small and medium enterprises since 2005. We also house over 40 technology and environmental businesses on campus in InfoLab21 and in the Lancaster Environment Centre (LEC).

A postgraduate qualification in science and technology is the ideal launch pad for your professional career in the UK or overseas.

Science and Technology at Lancaster University puts emphasis on interdisciplinary working approaches. It is common for students’ research projects and Masters programmes to cross traditional subject boundaries, to gain new insights into problems that are too complex for any single discipline to tackle. For example, the MSc in Data Science is providing a holistic view as to how to make sense of the worldwide deluge of available data by drawing upon expertise from the departments of Mathematics and Statistics, the School of Computing and Communications, and LEC. Our PhD in Natural Sciences offers the chance for research students to facilitate and enhance cross-disciplinary interactions within Science and Technology.

Dean of Faculty
Professor Mary Smyth

Associate Dean for Postgraduate Studies
Dr Chris Edwards

Associate Dean for Research
Professor Jamshed Anwar

Number of postgraduate students
594 Research
322 Taught
## Departments

<table>
<thead>
<tr>
<th>Page</th>
<th>Department</th>
</tr>
</thead>
<tbody>
<tr>
<td>170</td>
<td>Chemistry</td>
</tr>
<tr>
<td>175</td>
<td>Computing and Communications</td>
</tr>
<tr>
<td>181</td>
<td>Engineering</td>
</tr>
<tr>
<td>188</td>
<td>Lancaster Environment Centre (LEC)</td>
</tr>
<tr>
<td>204</td>
<td>Mathematics and Statistics</td>
</tr>
<tr>
<td>210</td>
<td>Physics</td>
</tr>
<tr>
<td>215</td>
<td>Psychology</td>
</tr>
</tbody>
</table>
Chemistry

The newly-founded Department of Chemistry boasts an expanding team of research-active staff at the forefront of research in their respective fields. It benefits from a significant investment from the University, and an extensive array of new instrumentation and equipment to support its ambitious research activity.

The Department is a vibrant, expanding community populated by both undergraduate and postgraduate students, and dedicated research, technical and support staff whose research interests span and extend beyond the traditional boundaries of Chemistry.

Our vision for the Department is ambitious; to create a Department with both research and teaching that is competitive with the very best the UK has to offer. Our staff come from a variety of research backgrounds and thus have interests spanning many areas of both fundamental and technological interest. Perhaps most importantly, we share common ground in research-excellence, an inclusive and collaborative spirit, and a dedication to passing on our knowledge to a new generation of researchers.

As part of the University’s investment in Chemistry, we have a major building redevelopment programme that will provide the Department with new, extensively equipped synthetic, physical and computational research laboratories, data analysis suites, and a major new spectroscopy suite. A series of communal areas for use by both staff and students will form a major part of the new development.

We are also significantly expanding the range of instrumentation and equipment available for research, including investment in a host of NMR spectrometers, mass spectrometers, fluorimeters, x-ray diffractometers, and extensive facilities for analytical, air-sensitive and computational chemistries. We also benefit from a local high-performance computing facility and Lancaster’s membership of the N8 group of Universities, providing us access to additional facilities.

Research degrees

PhD

Entry requirements

Upper second class undergraduate or Masters degree in Chemistry, or an equivalent degree in a related discipline such as Physics or Chemical Engineering, appropriate to the proposed research project.

IELTS

6.5 or equivalent (lower grade admissions may be possible via separate pre-sessional English courses).

Assessment

Original research and thesis.

Further information

www.chemistry.lancs.ac.uk

We welcome applications from those seeking to perform leading fundamental and technologically relevant research for the degree of PhD. Research opportunities are available within each of our research areas, which are broadly categorised as analytical chemistry and spectroscopy; chemical biology and soft-matter; chemical theory and chemical computation; energy materials, catalysis and sustainable chemistry; supramolecular and structural chemistry; and synthetic chemistry.
Our PhDs, whilst predominantly research based, are supported by a selection of taught courses providing skills in many modern research techniques, including analytical chemistry, experimental design, advanced laboratory techniques, spectroscopy and computational chemistry, together with courses to develop your transferable skills. This ensures that our postgraduate students extend their knowledge of all areas of chemistry, and possess a wide range of skills to aid employability.

Chemistry at Lancaster prides itself in its research transcending traditional discipline boundaries, for example linking with Biology and Medicine, Engineering, the Lancaster Environment Centre, and Physics. The Department is a friendly, inclusive environment that actively encourages collaboration with other members of Chemistry, with other disciplines within the University, and the global community, enabling us to tackle real-world applications in unique ways.

You should feel free to contact us with any enquiries about our research, and about the possibility of undertaking a research degree here in Lancaster. If you have a particular project in mind, please feel free to contact directly the appropriate member of staff.

As our team of academic staff is set to expand over the coming months and years, further research opportunities may become available. You should check the Chemistry Department's website for current information on our staff and the potential research projects we offer.

Research degrees
- PhD
- PhD in Natural Sciences
- MSc in Chemistry (by research)

Head of Department
Professor Peter Fielden

Head of Research
Professor David Middleton

Postgraduate enquiries
Emma Shaw
Tel: +44(0)1524 593241
Email: chemistry@lancaster.ac.uk
www.chemistry.lancs.ac.uk
Research degrees (continued)

PhD in Natural Sciences

Entry requirements
Upper second class undergraduate or Masters degree in Chemistry, or an equivalent degree in a related discipline such as Biochemistry, Biophysics, Physics, Computation or Chemical Engineering, appropriate to the proposed research project.

IELTS
6.5 or equivalent (lower grade admissions may be possible via separate pre-sessional English courses).

Assessment
Original research and thesis.

Further information
www.chemistry.lancs.ac.uk

This new course offers an academic training route for graduates seeking to perform leading fundamental and technologically relevant research that transcends the traditional discipline boundaries, linking one or more other disciplines with Chemistry. Options include Biology and Medicine, Computation, Engineering, Physics and the Lancaster Environment Centre. This course is particularly suitable for students who wish to specialise in disciplines other than their primary chosen background, but do not want an award in the new traditional discipline.

A substantial amount of research both at the national and international level is interdisciplinary, addressing research questions that fall between the boundaries of traditional disciplines. Indeed real world problems tend to require a multi-disciplinary approach and research expertise at the interfaces of these disciplines is essential to delivering impactful solutions. A PhD award in Natural Sciences will capture and give expression to such research training, giving graduates a competitive advantage in the careers market place. Career opportunities exist right across the scientific spectrum including industry, academic and research institutions, and public sector organisations such as schools and science laboratories.

The PhD, whilst predominantly research based, will be supported by a selection of taught courses across the relevant disciplines, including lectures, seminars and workshops, providing skills in many modern research techniques in the physical and biological sciences.

MSc in Chemistry (by research)

Entry requirements
Upper second class undergraduate or Masters degree in Chemistry, or an equivalent degree in a related discipline such as Physics or Chemical Engineering, appropriate to the proposed research project.

IELTS
6.5 or equivalent (lower grade admissions may be possible via separate pre-sessional English courses).

Assessment
Original research and dissertation.

Further information
www.chemistry.lancs.ac.uk

Our new Masters by research programme provides the opportunity to undertake a short, in depth independent research project in one of our research groups. It will equip you for more sustained and original work at the doctoral level or for advanced-level applied research positions. This degree will develop relevant analytical and technical skills, together with transferable skills related to research, communication, problem solving, and independent working.

For information on possible projects, and for further details of our specific research interests, see the research interests section and also our Department website.
Our research interests

Research in the Department is broadly structured into a series of sub-disciplines or themes, some of which are focused around the underlying science, including synthetic chemistry; chemical theory and computation, and analytical chemistry and spectroscopy. The remainder of the sub-disciplines refer more to the applications of our research, currently energy materials, catalysis and sustainable chemistry; supramolecular and structural chemistry; and chemical biology and soft matter. Below is a brief outline of some of our current interests; due to the interdisciplinary nature of our research, many topics fall within several of our research themes, so please look carefully at all sections of the list. Prospective students may also suggest projects that are variations on those listed below, it is just a prompt to show where our interests and skills lie.

Analytical Chemistry and Spectroscopy: there are a diverse range of subjects that fall within the broad discipline of analytical chemistry at Lancaster; analytical spectroscopy, chromatography, mass spectrometry, electroanalysis, micro-separations, sensor design and lab-on-a-chip devices all feature as techniques that can facilitate the measurement of chemical parameters within the discipline. Applications are widespread and include: industrial process measurement and control, healthcare diagnostics, materials characterisation, forensics and security. At Lancaster, analytical chemistry is studied as a fundamental academic discipline, but is also applied to many applications that generate impact and that serve to enhance the quality of life.

A major focus of our spectroscopy research is in solid-state NMR spectroscopy, which is allied with a range of chemical, biophysical and molecular biology techniques, to study the structure and dynamics of protein assemblies and complexes. Current projects include investigating the structural features of protein-protein and protein-ligand interactions in biological membranes, and the molecular basis for protein self-assembly.

Another focus of our spectroscopy research is on the understanding, investigation and development of solar cells. In particular, possible projects involve development of low cost, high efficiency solar cells; photon management for efficient solar energy collection and photophysical properties of light harvesting structures.
Our research interests (continued)

Chemical Theory and Chemical Computation: theory and computational methods now go hand-in-hand with experiments, enhancing our molecular level understanding, rationalising experimental data and informing better and fewer experiments. Electronic structure theory involves the determination of the chemical and photo-physical properties of molecules or periodic solids using computational methods, from only knowledge of the constituent nuclei and electrons. The group is developing computational methods that are increasingly accurate and efficient. These methods can facilitate the design of molecules and materials for specific functions, including energy, catalysis, structural chemistry and spectroscopy. Moving up the scale, computational methods are being applied to molecular assemblies using molecular dynamics simulations and free energy calculations. Here the interest is in self-assembly, phase transformations and interactions between assembled structures, and how assembled structures can be perturbed or dissolved.

Possible research projects include:
The prediction of phase behaviour and solubility from first principles • Nucleation in soft matter, towards developing approaches to prevent amyloid formation in diseases such as Alzheimer’s, and in crystals • Development of anti-nucleating agents • Crystal engineering, including formation and stability of nanocrystals • Development of new first-principles techniques in density functional theory • Developing DFT for large biologically relevant systems • Theoretical spectroscopy and improving accuracy for electronic excited state property prediction with applications in OLED design • Modelling dispersion to accurately describe intermolecular interactions in applications such as protein folding • The adiabatic connection approach to functional development • Theoretical transition metal chemistry • The prediction of the structure and properties of porous materials.

Synthetic Chemistry: synthesis underlies all aspects of chemistry; the design, creation and characterisation of molecules and materials are at the heart of our research activity across all areas of chemistry. The application of our synthetic research spans fundamental synthesis for the development of pharmaceuticals, the development of custom-designed polymers, and the development of lumophores with applications in biologically-targeted imaging agents.

Potential projects in these areas include:
Organic synthesis • Organic methodology development • Catalysis • Mechanistic chemistry • Development of new organic reaction methodologies • Asymmetric synthesis and catalysis • Organometallic chemistry and catalysis • Palladium-catalysed coupling reactions • Catalytic decarboxylative cross-coupling reactions • Investigation of organometallic reaction mechanisms • Medicinal chemistry • Natural product synthesis • The development of new methods and strategies for polymer synthesis • Synthesis of alternating copolymers • Catalytic synthesis of polymers • Synthesis of biodegradable polymers • Coordination chemistry of early transition metals • Early transition metal organometallic chemistry • Development of mid- to late- transition metal complexes for cell imaging applications • Tuning the properties of imaging agents to target biological targets • Synthesis and spectroscopic studies of lumophores based on early transition metals for applications in imaging, photovoltaic and light-emitting applications • Molecular cages for the delivery of small molecules or ions to cells or biological compartments for imaging and therapeutic applications.
School of Computing and Communications

The School of Computing and Communications is home to the University’s world class research and teaching activities in the areas of Computer Science, Communication Systems and ICT.

The School offers an extensive range of high quality options for postgraduate study. With 45 academic staff, 39 researchers and 400 students (approximately 200 of which are enrolled on postgraduate programmes) the School provides a vibrant learning environment built on an internationally renowned research portfolio.

Your postgraduate studies will place you in the heart of an academic unit ranked tenth in the UK in the most recent Research Assessment Exercise (100% of our output was identified in the RAE as being of international quality). Our latest teaching quality review received the highest possible ranking.

You will experience high quality tuition from globally recognised academics including individual supervision and mentoring. Combined with state-of-the-art teaching spaces and laboratory resources, our extensive PhD programme and unique range of one year MSc courses will ensure that you work at the highest level possible.

Our partnerships with industry and commerce are exemplary and you can benefit from organised placement activities within our flagship MSc programmes. Additionally, internships and project/dissertation placements are available alongside opportunities for part-time employment.

A range of funding opportunities are typically available for a number of our postgraduate degrees. Please visit our website for up-to-date details: www.lancs.ac.uk/study/postgraduate/postgraduate-fees-and-funding

Whatever your career aspirations our open door policy means that our dedicated academic staff are always on hand to help you realise them. We look forward to welcoming you to your future at Lancaster.

Research degrees
- PhD
- MSc by Research

Integrated degrees (1+3)
- PhD (HighWire)

Taught programmes
- MSc in Computer Science
- MSc in Communication Systems
- MSc in Cyber Security
- MSc in Data Science
- MSc in E-Business and Innovation
- MSc in International Innovation (Computer Science)

Number of postgraduate students
200

Head of School
Professor Jon Whittle

Course enquiries
Tel: +44 (0)1524 510311
Email: scc-msc-enquiries@lancaster.ac.uk
www.scc.lancs.ac.uk

Research enquiries
Tel: +44 (0)1524 510515
Email: scc-phd-enquiries@lancaster.ac.uk
www.scc.lancs.ac.uk
Research degrees

PhD

Director of Studies
Dr Gerald Kotonya.

Entry requirements
Upper second class honours degree, or its equivalent, in Computing, Electronics/Electrical Engineering, Mathematics or a closely related discipline.

IELTS
6.5 or equivalent.

Assessment
Original research and thesis.

Further information
www.scc.lancs.ac.uk/phd

We welcome applications from well qualified, able and enthusiastic students for PhD (three years full-time, four to six years part-time) in any of our research areas.

We recommend that you visit our website to read the latest information about our projects and research areas. Here you will also find details on preparing proposals, on contacting individual staff and on funding.

Under individual supervision you’ll work to become a leading expert in your area, while research skills courses will support your learning and help you realise your maximum potential. Annual progress review panels keep your work on track and our seminar programmes and state-of-the-art facilities provide access to ideas and technologies that stimulate your development as a research scientist.

There are numerous opportunities to collaborate and to present your research nationally and internationally via our extensive research and industrial partnerships. Also, you may have the opportunity to work as a teaching assistant on our taught programmes; a valuable source of experience and income.

MSc by Research

Director of Studies
Dr Gerald Kotonya.

Duration
12 months full-time, 24 months part-time.

Entry requirements
Upper second class honours degree, or equivalent.

IELTS
6.5 or equivalent.

Assessment
Learning contract, literature review and dissertation.

Further information
www.scc.lancs.ac.uk/phd

The MSc by Research programme can be tailored to your individual research needs.

You will first take an induction course leading to the production of a learning contract with a research supervisor and subsequently develop a research proposal that forms the basis of the rest of your study.

You will then progress to a period of independent research project work and complete a project dissertation. Upon successful completion of the MSc, you will have clearly demonstrated your ability to meet the required high levels of technical professionalism.
Our research interests

The work of the School of Computing and Communications spans five major sub fields of research:
- Communications and Networking
- Computer Systems
- Intelligent Systems
- Software Engineering
- Human-Computer Interaction

Across all activities, our research shares a strong engineering ethos that emphasises an understanding of real-world challenges and focuses on the development and experimental evaluation of systems.

Our research is supported by grants from the UK Research Councils, the European Commission and industrial sponsors. The total value of our current grants exceeds £12m.

Our grant portfolio reflects our commitment to collaborative research, including international research. We attract more funding per staff member for Computing and Communications research from Europe than any other university in the UK.

We are actively engaged in interdisciplinary research in areas ranging from signal processing and wireless networking to innovative user interaction, software engineering, cyber security and natural language processing.

In addition to our focused academic research, we believe in conducting research in partnership with end users and industry. We have research projects in many areas including health transport; energy management; online security, crime fighting, counter terrorism; environmental informatics, emergency response and computing for energy conservation. This has led to the establishment of numerous test beds and long term deployed ‘Living Laboratories’ with real communities (e.g. Wray wireless-mesh, e-Campus interactive public displays). These serve as unique resources for conducting novel research and supporting teaching.

Integrated degrees (1+3)

HighWire: Creating Innovative People for Radical Change in the Digital Economy

Director of Studies
Professor Gordon Blair.

Discipline specific advice
Professor Gordon Blair (Computing and Communications); Dr Paul Coulton (Design); Dr Mike Chiasson (Management).

Entry requirements
Upper second class honours degree or Masters degree, or equivalent, in one of the following disciplines; Computing, Design or Management.

IELTS
6.5 or equivalent.

Assessment
Original research and thesis.

Further information
http://highwire.lancs.ac.uk

HighWire is a world-class, cross-disciplinary and user centric Centre for Doctoral Training which brings together Lancaster’s extensive expertise in Computing, Design and Management.

We go beyond multidisciplinary approaches by seeking a creative fusion between three key disciplines, aiming to produce a new breed of innovative people who are able to drive exciting advances in technical, design and business innovation.

The programme’s continuing relevance is ensured by our close alignment with the needs and goals of business and industry. We encourage technology exchange and early adoption of emerging technologies, processes and ideas. HighWire graduates can work in challenging roles in organisations, driving radical change in the digital economy.

The programme spans four years beginning with formal and practical training, leading to a Masters of Research (MRes) and then progressing to PhD study.

For more information on Lancaster’s Centres for Doctoral Training, please see page 24.
**Taught programmes**

**MSc in Computer Science**

**Director of Studies**  
Dr Andreas Mauthe.

**Duration**  
12 months full-time, 24/36 months part-time.

**Entry requirements**  
Second class honours degree, or its equivalent, in Computer Science or a closely related discipline. Relevant industry experience may be considered.

**IELTS**  
6.5 or equivalent.

**Assessment**  
Coursework and dissertation.

**Further information**  
[www.scc.lancs.ac.uk/masters/ComputerScience](http://www.scc.lancs.ac.uk/masters/ComputerScience)

You will study the design and construction of systems in terms of their architecture and integration, the challenges that the proliferation of data poses, how to model and represent data using semantic web technologies, how to use data mining and machine learning techniques for tasks such as social network analysis and recommender systems, and how information can be presented in a manageable form on a range of devices including smartphones and tablets.

The degree also provides a fully organised work placement in either industry or research. Our dedicated Knowledge Business Centre maintains links to over 500 partner companies to ensure students who wish to do so can apply their knowledge and skills in a real-world industrial capacity. Alternatively, you can engage with our internationally renowned research groups within the School, thereby gaining expertise and insights into state-of-the-art research.

**Core modules**
- Elements of Distributed Systems
- Advanced Human-Computer Interaction
- Data Mining
- Systems Architecture and Integration
- Advanced Human-Computer Interaction II
- Applied Data Mining
- Professional and Research Methodology
- Research or Industrial Placement
- A Research or Industrially Focused Dissertation

**MSc in Communication Systems**

**Director of Studies**  
Professor Qiang Ni.

**Duration**  
12 months full-time, 24/36 months part-time.

**Entry requirements**  
Second class honours degree, or its equivalent, in Electronic/Electrical Engineering, Physics or Mathematics. Relevant industry experience may be considered.

**IELTS**  
6.5 or equivalent.

**Assessment**  
Coursework, exams and dissertation.

**Further information**  
[www.scc.lancs.ac.uk/masters/CommunicationSystems](http://www.scc.lancs.ac.uk/masters/CommunicationSystems)

This course is primarily concerned with providing graduates with the specialist skills associated with next generation digital telecommunications such as WiMAX and Long Term Evolution (LTE) wireless broadband communication systems, IP Multimedia Subsystem (IMS), MIMO systems, space-time coding, software defined radio, and reconfigurable analogue and digital RF systems. It also provides knowledge and skills in the general use of DSP techniques in many different areas including robotic, autonomous, medical, geophysical, aerospace, automotive and environmental systems.
The degree also provides a fully organised work placement in either industry or research. Our dedicated Knowledge Business Centre maintains links to over 500 partner companies to ensure that students who wish to do so can apply their knowledge and skills in a real-world industrial capacity. Alternatively, students can engage with our internationally renowned research groups within the School, thereby gaining expertise and insights into state-of-the-art research. Graduates from this course are actively sought after by employers in high technology industries.

**Core modules**
- Digital Communications
- Advanced Communications
- Speech and Image Coding
- Digital Signal Processing
- Wireless Broadband
- Advanced Filters and Systems
- Professional and Research Methodology
- Research or Industrial Placement
- A Research or Industrially Focused Dissertation

**MSc in Cyber Security**

**Director of Studies**
Professor Awais Rashid.

**Duration**
12 months full-time, 24/36 months part-time.

**Entry requirements**
Second class honours degree, or its equivalent, in Computing or a closely related discipline. Relevant industry experience may be considered.

**IELTS**
6.5 or equivalent.

**Assessment**
Coursework and dissertation.

**Further information**
[www.scc.lancs.ac.uk/masters/CyberSecurity](http://www.scc.lancs.ac.uk/masters/CyberSecurity)

The overall aim of this MSc is to equip you with the knowledge and skills necessary to work within the IT security profession. It takes advantage of Lancaster having recently been awarded the highly prestigious status of an EPSRC-GCHQ Academic Centre of Excellence in Cyber Security Research, and combines advanced technical skills with disciplines such as Economics, Risk Management, Psychology and Social Science. Its strength and uniqueness lies in its multidisciplinary nature, merging expertise from across Lancaster's faculties to educate the next generation of security specialists.

The technical modules within the degree offer the skills and knowledge required to enable students to obtain the industrially recognised professional qualifications of CISSP (Certified Information Systems Security Professional), CEH (Certified Ethical Hacker) and CHFI (Computer Hacking Forensic Investigator).

**Core modules**
- Information System Security Management
- Information System Penetration and Countermeasures
- Information System Forensic Investigation
- Information System Risk Management
- Cybercrime
- Introduction to Law for Cyber Security Specialists
- Network and System Security
- Security and Conflict in the Digital Age
- A Research or Industrially Focused Dissertation

For more information please go to [www.lancaster.ac.uk](http://www.lancaster.ac.uk)
Taught programmes (continued)

MSc in Data Science

Director of Studies
Dr Matthew Rowe.

Duration
12 months.

Entry requirements
A second class honours degree, or its equivalent, in a subject relevant to Computer Science, Mathematics or Statistics.

IELTS
6.5 or equivalent.

Assessment
Coursework and examination.

Further information
www.scc.lancs.ac.uk/masters/DataScience

This MSc programme is aimed at students who are interested in the cross-over between data analysis, computing and application. Students could, for example, hold a BSc in Mathematics and Statistics, a BSc in Ecology or Environmental Sciences, or a BSc in Computing, but backgrounds in other STEM (science, technology, engineering or maths) subjects are welcome to apply.

Within the programme, two specialism routes are available, statistical inference and computing.

Statistical Inference Specialism

A data scientist is a highly skilled individual with the ability to: articulate a research question; gather, process and model data at large-scale (developing scalable algorithms for performing inference and modelling complex and heterogeneous data structures) and to disseminate research findings in context.

This specialism provides a thorough training in data science fundamentals but with added focus upon statistical modelling and inference. Students will gain thorough training in computing, data science technologies, statistical inference, statistical modelling and applied data analysis. The MSc will involve a mixture of taught modules and a research dissertation with a placement in industry or with a research organisation.

Computing Specialism

Underpinning the data scientist role are the technologies that enable the processing of data at large-scale, often using parallel processing paradigms.

This specialism provides the training to understand how these technologies function and how they are implemented within both enterprise and research environments. Students will get hands-on experience of building, from scratch, large-scale systems that enable data science questions to be answered, using technologies such as Hadoop, Spark, Giraph, and HBase. This MSc will involve a mixture of taught modules and a research dissertation with a placement in industry or with a research organisation.

MSc in E-Business and Innovation

This is a collaborative scheme run jointly by the School of Computing and Communications and the Lancaster University Management School. Please see the Management School entry on page 139 for information.

MSc in International Innovation (Computer Science)

Please see the Management School entry on page 148 for information.

Key facts

The School of Computing and Communications is a world renowned centre of excellence for research, ranked amongst the top ten in the UK in the most recent assessment (RAE 2008). We attract more funding per staff member for Computing and Communications research from Europe than any other university in the UK.

Our flagship MSc Programmes offer fully organised industry placement opportunities to all students. The School’s Knowledge Business Centre will work with you to find the right match to its network of over 500 partner companies.
Engineering

The Engineering Department specialises in multidisciplinary engineering research, particularly in the areas of energy, nuclear engineering and Microsystems, and has close links with many industries.

The Department has expanded substantially since 2001 with subsequent research valued in excess of £6.5m. Support of students and research is obtained from a wide range of sources including Engineering and Physical Sciences Research Council (EPSRC), European Union (EU), Science and Technology Facilities Council (STFC), Technology Strategy Board (TSB), Charitable Foundations, Knowledge Transfer Partnerships (KTP) and industry. The Department continues to grow significantly with the construction of a new building in 2014. This will provide students with access to state-of-the-art teaching and research facilities.

In the 2008 Research Assessment Exercise, 100% of the research outputs from Engineering were judged to be internationally recognised. The Department is home to a number of dedicated research centres including the Lloyd's Register Foundation Centre for Nuclear Engineering and Decommissioning and the Lancaster Product Development Unit. Engineering also coordinates the cross-disciplinary research activity in energy, via Energy Lancaster, which is a founder member of the Cockcroft Institute for Particle Accelerator Engineering and is part of the EPSRC Next Generation Nuclear Centre for Doctoral Training and Sir John Fisher Foundation MSc by research scholarship scheme.

Industry values this excellence and the Department is one of the top rated in the country for graduate employment success.

Research degrees
- MSc in Engineering (by Research)
- PhD in Engineering
- EngD in Nuclear Engineering

Taught degrees
- MSc in International Innovation (Engineering)
- MSc/PgDip in Mechanical Engineering
- MSc/PgDip/PgCert in Safety Engineering (part-time)
- MSc/PgDip in Smart Systems Engineering
- PgCert in Aerospace Safety Engineering (part-time)
- PgCert in Nuclear Science and Engineering (part-time)

Number of postgraduate students
110

Head of Division
Malcolm Joyce

Postgraduate enquiries
Tel: +44(0)1524 592275
Email: Eng-GradAdm@lancaster.ac.uk
www.engineering.lancs.ac.uk

For more information please go to www.lancaster.ac.uk
Research degrees

MSc in Engineering (by Research)

Director of Studies
Individual supervisor.

Duration
12 months full-time,
24 months part-time.

Entry requirements
Upper second class honours degree, or equivalent, with strong evidence of excellence in research and writing.

IELTS
6.5 or equivalent.

Assessment
Interim reports with a final dissertation based on the research.

Further information
www.engineering.lancs.ac.uk

The Department has extremely good industry contacts and generates opportunities for short term industrial research projects, which can be linked to an MSc by Research in Engineering. These are ideal for students with industrial experience who wish to work in a specific area, and prefer flexibility to the taught MSc programmes.

Flexibility is the key to this programme. It begins with an induction that leads to a learning contract with a research supervisor and often an industry contact; this sets the direction of your research project work and identifies your research training needs. You then select from the research training programmes offered by the Faculty’s Graduate School to make sure that your skills are developed to meet your needs. Regular supervision and access to seminar groups, together with interim research reports, ensure good progress towards a final project dissertation.

The department has an annual MSc by Research scholarship scheme generously supported by the Sir John Fisher Foundation. This scholarship is open to students interested in nuclear or maritime engineering research.

PhD/EngD

Director of Studies
Individual supervisor.

Duration
3-4 years full-time,
4-7 years part-time.

Entry requirements
Upper second class honours degree, or its equivalent, in an Engineering or associated discipline. Relevant industrial or related experience will also be considered.

IELTS
6.5 or equivalent.

Assessment
Original research and thesis.

Further information
www.engineering.lancs.ac.uk

Applications for postgraduate study (full-time, part-time and industry based) by research, leading to either a PhD or EngD are welcomed. Research in the department is grouped into four main areas, each drawing on a range of different fields. The areas are:

- Structures and Manufacturing
- Micro-Nano systems
- Energy
- Engineering of Microwaves, Terahertz and Light (E-MIT)

The Engineering Doctorate (EngD) is an alternative to the traditional PhD for students who want a career in industry. A four-year programme combines PhD level research projects with taught courses. Please note that the EngD is dedicated to Nuclear Engineering.
Our research interests

Nuclear Engineering: this activity spans a broad range of interest from the radiation tolerance of electronic systems used in medical radiotherapy, leading to the development of instrumentation for radiation detection, through to materials characterisation and analysis, waste remediation and decontamination and the study of actinide chemistry.

Control: this includes research into modelling, control and optimisation of complex systems in engineering and the natural sciences; the design of control systems, with applied research spanning robotics; mechatronic systems engineering; environmental control; intelligent transportation systems; automation in agriculture and biomedical applications among other areas.

Mobile Robots: following on from the above, our research into mobile robots includes several international firsts in the area of construction and nuclear decommissioning robotics, such as our BROKK-based decommissioning robot, consisting of a moving vehicle with two, seven-function manipulators. This includes research into intelligent control for digging machinery, computer control, hydraulic actuators, sensor systems, drives, mechanism design, and the development of intelligent knowledge based systems.

Advanced Structures: we are a member of the North West Composites Centre. Our research includes reinforced polymer composites, and smart structures; analysis of the performance of structural grade GRP (Glass Reinforced Plastic) and HF (Hybrid Fibre) composite profiles, made by pultrusion (an efficient and economic composites manufacturing process); and, uses in secondary structures in aggressive environments. We also have a significant interest in Additive Manufacturing.

Micro and Nanosystems Engineering: our Micro and Nanosystems Engineering Research Group has research interests in system-on-chip and microsystem test and reliability engineering; integration of micro technologies into highly integrated systems; design methodologies and functions to aid manufacture of Micro and Nano Technology based systems; integration of test support functions into both system-on-chip applications and microsystem devices; design for micro and nano manufacture. Active projects in bio-MEMS related to integrated microfluidic sensor chip; design and test of data converters; novel modelling and design techniques for MEMS and modelling and analysis activities in nano electronic system design.

Energy: LUREG (Lancaster University Renewable Energy Group) covers a broad range of renewable technology areas. Specific expertise includes capturing the renewable energy of sea waves, tidal currents, hydropower and fluid machinery; wind power; electrical power systems and micro generation systems that could bring electricity to developing countries. The department also coordinates Energy Lancaster, a cross-disciplinary research group designed to tackle the global challenges of climate change by bringing together low carbon supply technologies.

Engineering of Microwaves, Terahertz and Light (EMIT): the EMIT research group has an international reputation for its work on RF systems for accelerators, vacuum electronics and high power microwave tubes. The group specialises in deflection and crab cavities for future high energy particle accelerators, synchrotron light sources and free electron lasers. The group has made novel contributions to the stimulation of travelling wave tubes, klystrons and magnetrons. It has demonstrated the use of an injection locked CW magnetron powering a superconducting cavity with accurate phase control. The group has a capability for design optimisation of specialist tubes, for example high efficiency broadband TWT amplifiers for next generation satellite communications systems, high efficiency multi-beam klystrons for future linear colliders, high power high efficiency CW magnetrons for long pulse proton drivers, compact X-band linacs for medical and security applications and high frequency tubes moving up the THz scale. The group has a developing activity in photonics.

Lancaster is a founder member of the Cockcroft Institute for Accelerator Science and Technology. Much of the group’s current work is done in close collaboration with the STFC Daresbury Laboratory, CERN in Geneva and JLab in the US. Internationally it has had recent and significant collaborations with the Stanford Linear Accelerator Laboratory (SLAC), Fermi-Lab and Central Electronics Engineering Research Institute in India (CEERI, Pilani). The group has long existing ties with the Beijing Vacuum Electronics Research Institute, the Beijing Medical Equipment Institute, the Institute of Electronics of the Chinese Academy of Sciences. Within the UK the group has industrial ties with E2V Technologies and Rapiscan Systems.
**Taught programmes**

**MSc in International Innovation (Engineering)**

Please see the Management School entry on page 148 for information.

**MSc/PgDip in Mechanical Engineering**

**Director of Studies**
Dr Sarah Green.

**Duration**
12 months full-time, 24 months part-time.

**Entry requirements**
Second class honours degree, or its equivalent, in Mechanical Engineering or related disciplines, or Physics. HND or equivalent together with appropriate industrial experience may be considered.

**IELTS**
6.5 or equivalent.

**Assessment**
Coursework and/or examination and a major project.

**Further information**
[www.engineering.lancs.ac.uk](http://www.engineering.lancs.ac.uk)

Mechanical Engineering is the basis of just about anything that has movable parts, which includes areas like transport (automotive, railway, aerospace), renewable energy, medicine and manufacturing. These areas will continue to be very important to the UK economy, and indeed to all developed economies.

The taught part of this course consists of six compulsory modules covering system design and modelling, mechanics, control, CAD/CAM, and renewable energy resources and devices. A major industrial project allows you to extend your knowledge by exploring an area that especially interests you, whilst giving experience of the way in which a complete product or process requirement in industry would be addressed.

The PgDip covers a selection of taught modules, with no individual dissertation. Students may progress to an MSc given good results.

**Modules**
- Intelligent System Control
- Mechanics and Actuators
- Advanced CAD/CAM
- Design and Modelling of Systems
- Renewable Energy
- Linking Group Project

**MSc/PgDip/PgCert in Safety Engineering**

**Director of Studies**
Dr Richard Dawson.

**Duration**
24 months part-time (industry based).

**Entry requirements**
A second class honours degree, or its equivalent, in an Engineering discipline. HND or equivalent together with appropriate industrial experience may be considered. UK/EU students only.

**IELTS**
6.5 or equivalent.

**Assessment**
Coursework and examination and a dissertation.

**Further information**
[www.engineering.lancs.ac.uk](http://www.engineering.lancs.ac.uk)

As engineering systems become more complex it is increasingly difficult to show that they will operate safely for their whole life. The programme addresses this problem by exposing students to the knowledge and techniques of safety engineering appropriate to a wide spectrum of industries.

It is suitable for those from a conventional engineering background who find themselves operating in a safety related industry, engineers in the early part of their careers, and those in senior management.

In addition to the generic safety modules, two modules deal with specific industries – Nuclear Engineering and Aerospace. Many high level industrial experts contribute to the course, as visiting speakers, and an important aspect of the course is a critical consideration of real accident case studies. Our graduates are much in demand.

The taught element of this course consists of eight modules in total; four per academic year. MSc students must submit an individual dissertation consisting of a substantial piece of literature-based research work in the area of study.

The PgDip and PgCert cover a selection of modules, with no individual dissertation. Students may progress to an MSc given good results.

**Modules**
- Engineering Research Methods
- Human Factors in Safety
- Nuclear Engineering Systems or Aerospace Engineering Systems
- The Design of Safety Critical Systems
- Nuclear Safety Environment or Aerospace Safety Environment
- Risk Analysis
- Strategic Safety Management

**Optional modules**
- Decommissioning Technologies
- Intelligent Control
- System Design and Modelling
MSc/PgDip in Smart Systems Engineering

Director of Studies
Dr Julia Hu.

Duration
12 months full-time,
24 months part-time.

Entry requirements
A second class honours degree,
or its equivalent, in a related Engineering discipline which may include Communications, Electrical Engineering, Computer Systems and Physics. A HND together with appropriate practical experience may also be acceptable.

IELTS
6.5 or equivalent.

Assessment
Combination of coursework and/or examination and a major project/dissertation.

Further information
www.engineering.lancs.ac.uk

This course will focus on these miniaturised systems which are able to describe and diagnose a situation, detect critical conditions, and identify and address each other. They may also be energy autonomous and networked.

Students will also study: methods of building control loops and associated software; the design of analogue and digital electronic interfaces; and, the manufacture of novel packaging technologies.

Applications in health care and medical diagnostics, automotive and aerospace, energy and environment, industrial control and consumer electronics will also be studied.

The dissertation will be on a major industrial project which will also allow you to extend your knowledge by exploring an area that especially interests you, whilst giving experience of the way in which a complete product or process requirement in industry would be addressed.

Modules
● Smart Systems
● Intelligent Control
● Advanced Embedded Systems
● Design and Modelling of Systems
● Linking Group Project
● Micro-System and System on Chip

PgCert in Aerospace Safety Engineering

Director of Studies
Dr Richard Dawson.

Duration
24 months part-time.

Entry requirements
Second class honours degree, or its equivalent, in an Engineering discipline. HND or equivalent together with appropriate industrial experience may be considered. UK/ EU students only.

IELTS
6.5 or equivalent.

Assessment
Coursework and examination.

Further information
www.engineering.lancs.ac.uk

As for the MSc and PgDip in Safety Engineering this course is suitable for those from a conventional engineering background who find themselves operating in a safety related industry, engineers in the early part of their careers, and those in senior management.

However, this course is most suited for those who are aerospace safety engineering practitioners who may not require the larger qualifications but who want to concentrate on Aerospace Safety Engineering topics. The taught element of this course consists of four modules in total; two per academic year which is also a very suitable study rate for particularly busy professionals. Upgrading to the higher qualifications during the course of study is possible should students wish but this will extend the period of study.

Modules
● Aerospace Engineering Systems
● Aerospace Safety Environment
● Systems Design and Modelling
● Intelligent Control

Silicon based electronics and embedded software now pervades the systems and devices we use on a daily basis and is the key enabling technology for internet based systems, automation and vehicle systems.

Taking silicon based electronics to the next level by adding micro sensors, micro actuators, biology and novel materials is now one of the primary goals of engineers and scientists within the international electronics community.

Advances have already been made through, for example, the integration of gyroscopes into mobile phones and the use of silicon micro mirrors in high definition displays. However, further advances over the coming years are expected to revolutionise health care, environmental monitoring, and energy by way of hand held devices for rapid detection of cancers, low cost toxin detection, and miniaturised energy harvesters (to replace batteries).
The course also covers nuclear engineering systems, including common thermal fission nuclear reactor designs; nuclear safety and the use of risk assessments; and nuclear decommissioning, including robotic systems and related technology. There is a focus on the UK and global nuclear industry, including the reasons for particular technology trends and the nature of regulation and culture in the industry. In addition, engineering science fundamentals are covered where appropriate for example thermodynamic efficiency and materials behaviour.

A wide range of learning and teaching strategies will be used to deliver these aims, including lectures, seminars, industrial site visits, group learning, directed reading and workshops.

With a buoyant engineering job market, the Postgraduate Certificate in Nuclear Science and Engineering will give individuals the opportunity to stand out from non-specialists.

**Modules**
- Nuclear Industry Foundations
- Nuclear Engineering Systems
- Nuclear Safety Environment
- Decommissioning Technology and Robotics
Lancaster Environment Centre

The Lancaster Environment Centre (LEC) forms one of the largest centres for environmental research in Europe.

At the heart of our work is a fundamental commitment to research and teaching which delivers academic excellence and real world impact. We work to address some of the most pressing issues of the twenty-first century.

Our interdisciplinary research themes deliver the understanding needed to address the global environmental challenges that confront us all.

Postgraduate students are taught by and work with world-class scientists in a wide range of environmentally related disciplines, alongside over 20 environmental businesses, thereby enhancing their future employment prospects in the environment sector and beyond.

We regard practical study as a key means of learning and we are fortunate to have a variety of areas of scientific interest on our doorstep. Depending on your area of study you may have the opportunity for field work in the Lake District, Morecambe Bay or even further afield at Mount Etna in Sicily or in West Africa.

Enterprise and Business Partnerships provide a major focus for collaborative work with the commercial sector and we offer a Work Placement programme, which gives students the opportunity to gain real-world experience on a collaborative project with business. This experience often links to dissertations.

As well as excellent research opportunities we have a range of Masters programmes combining taught modules with a substantial research project, all grouped into thematic areas. These offer transferable skills suitable for research, consultancy and industry.

Key fact

Over 85% of our Masters graduates go on to employment or further study, with 14% undertaking further study.

Key fact

New courses, including collaborations with industry leading experts, are about to be launched shortly. Please visit our website for the most up-to-date course listings: www.lancaster.ac.uk/lec/postgraduate/
Research degrees
- MSc in Plant Sciences by research
- MSc in Ecology by research
- MSc in Environmental Science by research
- PhD in Biological Science
- PhD in Environmental Science
- PhD in Geography

Taught degrees
- LLM/MA in Environment and Law
- LLM/MA in Human Rights and the Environment
- MSc/PgCert in Contamination, Risk Assessment and Remediation
- MSc in Data Science for the Environment
- MSc/PgCert in Ecology and Conservation
- MSc in Energy and the Environment
- MSc in Environmental and Biochemical Toxicology
- MA/MSc/PgCert in Environment and Development
- MA/MSc in Environment, Culture and Society
- MA in Environmental Management and Consultancy
- MSc/PgCert in Environmental Science and Technology
- MSc in International Innovation (Environmental Science)
- MSc in Resource and Environmental Management
- MSc/PgCert in Sustainable Agriculture and Food Security
- MSc/PgCert in Sustainable Water Management
- MSc in Volcanology and Geological Hazards
- MSc (Research) International Masters in Environmental Science and Technology
- MSc (Research) International Masters in Sustainable Agriculture and Food Security

Number of postgraduate students
260

Director of Lancaster Environment Centre
Professor Kevin Jones

Postgraduate research enquiries
Andy Harrod
Tel: +44 (0)1524 510477
Email: lec.pg@lancaster.ac.uk
www.lancaster.ac.uk/lec/postgraduate/postgraduate-research

Postgraduate taught enquiries
Stacey Read
Tel: +44 (0)1524 510257
Email: lec.pg@lancaster.ac.uk
www.lancaster.ac.uk/lec/postgraduate/taught-masters

Julie Anna-Lize Terry
MSc Ecology and Conservation

Lancaster was my first choice due to the reputation of the Lancaster Environment Centre, and the flexibility of the programme. The choice of modules is great as you can tailor your Masters to your interests, and I’ve been able to focus on water pollution and processes. The field visits have been the most enjoyable part for me, and the one-week field course on Catchment Protection in the Eden Valley was intensive, but really valuable. As a mature student, studying at postgraduate level has been challenging at times, but I was able to change to part-time so that I could still work, and I’m definitely making the most of my course. I recently returned from a five-month Erasmus exchange programme in the Netherlands where I completed two of my optional modules. I’m now finishing my dissertation project as a student volunteer for The Centre for Ecology and Hydrology at Wallingford, working in the field and in the laboratory on the flow cytometer. For me though, the best part is that the Student Employability Manager at Lancaster has just helped me organise a paid internship at The National Institute of Water and Atmospheric Research (NIWA) in New Zealand to follow on from my MSc this year.
Our research interests

Research within LEC is organised into several interdisciplinary research themes and within each theme there are many specialist research groups. These are headed by permanent staff and usually supported by post-doctoral research associates and technicians.

You will become an integral part of these teams and benefit from intellectual and laboratory support. You will be allocated a supervisory team who will support you through your studies and you’ll meet regularly with your supervisors to discuss research progress and identify any gaps in skills. You’ll be part of the vibrant research environment, contributing directly to the research achievements of LEC.

Atmospheric Science: our research in atmospheric measurements, including remote sensing and the modelling of atmospheric processes from the local to global scale, is conducted in an Earth system or a “sustainable atmosphere” framework. Currently we focus on the emissions of volatile organic compounds produced by organisms, understanding their role in climate/land/atmosphere feedbacks, particularly those involved in surface energy balance and tropospheric chemistry. Our research delivers benefits by contributing to improved pollution control and possible options for mitigating climate change.

Biodiversity and Conservation: two of the most urgent environmental issues facing mankind are global change and the accelerating loss of biological diversity. Our research investigates how biodiversity influences the services provided by both natural and managed ecosystems (including food production), and how ecosystems can be managed to protect and enhance biodiversity under global change. We use a variety of perspectives, with studies ranging from fundamental evolutionary ecology to the interactions of social and ecological constituents in the Earth-system.

Earth Sciences: our core research areas are geological hazards, palaeoclimate, geophysical imaging, sedimentology, tectonics, and planetary geology. Our specific aims are to mitigate natural hazards through understanding the fundamental physical and chemical processes involved and to develop quantitative methods for characterising and monitoring geological environments and for palaeoclimate reconstruction.

Environmental Chemistry: our research aims to improve the fundamental understanding of how chemicals behave in the environment, whether they are natural or man-made, essential nutrients or potential pollutants. We work closely with policy makers to help them assess the risks and benefits of environmental chemicals, and with industry, helping to develop chemicals that achieve their purpose without causing harm to the environment or humans.

Plant and Crop Science: with the global population expected to increase to 9 billion by 2050, there is a pressing need to secure access to sufficient safe and nutritious food for everyone. We combine cutting-edge research in plant science, from the molecular to the crop scale, with other disciplines in both the natural and social sciences. By working closely with research users, our research has a clear, practical focus on sustainable agriculture and so can help address the ecological, economic and social challenges facing crop production in a rapidly changing global environment.

Society and Environment: we focus on the interdisciplinary investigation and critical analysis of contemporary social and environmental challenges in regions including Africa, the Americas, Australia, East Asia and the Middle East. Our theoretical interests are in: knowledge, expertise and governance; space, scale, time and socio-spatial relations; political economy; and socio-technical change. These concepts are explored through empirical research that seeks to contribute to the cross-cutting societal goals of sustainable development, social and environmental justice.

Water and Soil Sciences: our water research takes the latest discoveries in water science and works with the world-wide water industry, policy makers and others to deliver innovative solutions for a sustainable supply of clean water for everyone. Our soils research brings together the biological, chemical and physical aspects of soil sciences to obtain an integrated understanding of this vital environmental resource.
Research degrees

Research projects leading to the award of a PhD or Masters by Research are available in all areas of the Biological, Ecological, Geographical and Environmental Sciences within LEC.

MSc in Plant Sciences by research

MSc in Ecology by research

MSc in Environmental Science by research

Duration
12 months full-time,
24 months part-time.

Entry requirements
Upper second class honours degree, or its equivalent, in a relevant subject. Industry based experience will be considered, with demonstration of appropriate skills.

IELTS
6.5 or equivalent.

Assessment
Original research and dissertation.

Further information
www.lancaster.ac.uk/lec/postgraduate/postgraduate-research

These programmes are suitable for those wishing to carry out a short, in depth research project, and not attend taught programmes. The MSc by research programmes consist of induction courses, an eight month research project and a period to write it up.

These degrees are carefully tailored to your interests, and can be particularly suitable for people undertaking research in a work based context wishing to gain an academic qualification.

PhD in Biological Science

PhD in Environmental Science

PhD in Geography

Entry requirements
Upper second class honours degree, or its equivalent, in a relevant subject, or lower first degree supplemented by a Masters qualification, and a viable research topic.

IELTS
6.5 or equivalent.

Assessment
Original research and thesis/collection of published papers.

Further information
www.lancaster.ac.uk/lec/postgraduate/postgraduate-research

A great strength of LEC is its ability to share expertise and ideas from many disciplines in order to provide a flexible approach, which is so important in the dynamic, rapidly developing discipline of Environmental Science. Although the work is often organised within themes and research groups there is much collaborative activity transcending these boundaries.
**Taught Programmes**

**LLM/MA in Environment and Law**

**LLM/MA in Human Rights and the Environment**

Please see entries under Law on pages 62 and 63.

**MSc/PgCert in Contamination, Risk Assessment and Remediation**

**Director of Studies**
Professor Kirk T Semple.

**Duration**
12 months full-time, 24 months part-time.

**Entry requirements**
Upper second class honours degree, or its equivalent, in a relevant subject. We can also consider applicants with a lower second class (or equivalent) if they have relevant work experience (including voluntary work).

**IELTS**
6.5 or equivalent.

**Assessment**
Coursework, presentations, examinations and dissertation.

**Further information**
www.lancaster.ac.uk/lec/postgraduate/taught-masters

The scheme links with key agencies involved in studying and controlling this threat. Case studies are used extensively to illustrate the application of the taught material and specifically include detailed investigations into the risk assessment and remediation of contaminated land sites.

You will gain the scientific, analytical and communication skills required to prepare you for a career in remediation work with local authority and industry, with the Environment Agency, or in consultancy.

The PgCert provides an opportunity for postgraduate learning and professional development for those who are unable to commit to a full MSc programme. The award requires the successful completion of four 15 credit modules, selected from the modules available on the MSc course.

**Core modules**
- Behaviour of Pollutants in the Environment
- Dissertation Project
- Chemical Risk Assessment
- Contaminated Land and Remediation
- Pollution Microbiology

**Optional modules**
Two optional modules from the following (subject to change)
- Data Analysis and Interpretation
- Data Analysis and Programming Skills
- Data Assimilation and Integration
- Environmental Applications of Isotope Geochemistry
- Environmental Radioactivity
- Environmental Sampling and Analysis for Trace Organics
- Environmental Toxicology
- Geoinformatics
- Numerical Skills
- Safety and Environmental Impact Assessment: an Industrial Perspective

**MSc in Data Science for the Environment**

**Director of Studies**
Dr Ian Hartley.

**Duration**
12 months.

**Entry requirements**
Upper second class honours degree, or its equivalent, in a relevant subject.

**IELTS**
6.5 or equivalent.

**Assessment**
Coursework and examination.

**Further information**
www.lancaster.ac.uk/lec/postgraduate/taught-masters

This MSc programme is aimed at students with a background in environmental, earth or ecological sciences who want to develop strong quantitative, data handling and analytical skills for application within their field.

The production of data that are relevant to environmental issues is increasing at a phenomenal rate. Technological advances in fields such as remote sensing, imaging and forecasting are increasingly producing data from more sources and with higher resolution than we have been able to handle until recently. There is a need for data scientists who are able to organise, analyse and disseminate such data in order to answer questions which will help us manage a range of scenarios, from management of natural resources to predicting population change.

This programme will involve a mixture of taught modules and a research dissertation with a placement in industry or with a research organisation.
MSc/PgCert in Ecology and Conservation

Director of Studies
Dr Ian Hartley.

Duration
12 months full-time, 24 months part-time.

Entry requirements
Upper second class honours degree, or its equivalent, in a relevant subject. We can also consider applicants with a lower second class (or equivalent) if they have relevant work experience (including voluntary work).

IELTS
6.5 or equivalent.

Assessment
Coursework, presentations, examinations and dissertation.

Further information
www.lancaster.ac.uk/lec/postgraduate/taught-masters

This is one of our most popular postgraduate schemes.

At the heart of its success is flexibility of choice from a wide range of modules that meet the needs or interests of any student of ecological or conservation sciences. This vocational degree offers you the chance to blend ecological and environmental science topics with those from areas such as social science, geography, and statistics.

This MSc provides you with an understanding of the relationships between living organisms and their physical, chemical and biotic environment whilst also providing important specific skills related to environmental monitoring and management.

The course also develops transferable skills appropriate to a career in research, consultancy or industry. Graduates have gone on to pursue careers in the environmental and conservation sectors, as well as progressing to further study for a PhD.

The PgCert provides an opportunity for postgraduate learning and professional development for those who are unable to commit to a full MSc programme. The award requires the successful completion of four 15 credit modules, selected from the modules available on the MSc course.

Core module
- Dissertation Project

Optional modules
Six optional modules from the following (subject to change)
- Air Quality and Climate
- Biological Effects of Air Pollution and Climate Change
- Chemical Risk Assessment
- Conservation and Sustainable Development in the Brazilian Amazon
- Conservation Biology
- Contaminated Land and Remediation
- Crop Protection
- Data Analysis and Interpretation
- Data Assimilation and Integration
- Environmental Management
- Environmental Sampling and Analysis for Trace Organics
- Environmental Toxicology
- Food Security, Agriculture and Climate Change
- Geoinformatics
- Habitat Management
- Lake Ecology
- Modelling Environmental Processes
- Pollution Microbiology
- Sustainable Soil Management
- Using the NVC
- Wildlife Monitoring Techniques
- Wildlife Population Ecology
Taught programmes (continued)

MSc in Energy and the Environment

**Director of Studies**
Dr Andy Jarvis.

**Duration**
12 months full-time, 24 months part-time.

**Entry requirements**
Upper second class honours degree, or its equivalent, in a relevant subject. We can also consider applicants with a lower second class (or equivalent) if they have relevant work experience (including voluntary work).

**IELTS**
6.5 or equivalent.

**Assessment**
Coursework, presentations, examinations and dissertation.

**Further information**
[www.lancaster.ac.uk/lec/postgraduate/taught-masters](http://www.lancaster.ac.uk/lec/postgraduate/taught-masters)

The use of energy derived from fossil fuels is releasing large quantities of carbon into the earth's atmosphere. This carbon is causing present-day changes to climate and, more importantly, is committing society to very significant changes in the future.

In recognition of the threats presented by climate change, the UK has committed to an 80 per cent reduction in greenhouse gas emissions by 2050. Meeting this target will represent one of the grand challenges of the next 40 years and a large number of scientists and engineers will be needed to achieve this.

The changes required will cover our entire socio-economic system and will include widespread installation of renewable energy technologies, ubiquitous use of energy saving devices, new forms of transport and heating, low carbon buildings, resource light manufacturing, and changes in agricultural practices. A large number of scientists and engineers with system wide expertise will also be needed.

The MSc in Energy and Environment is designed for those wishing to develop careers in this challenging and exciting area. The taught component of the programme is interdisciplinary and encompasses environment, engineering and policy.

The research project, working on an energy sector application, may be developed in conjunction with an industrial partner. These industry projects will not only give valuable industry relevant training but will also provide work experience.

**Core modules**
- Dissertation Project
- Environmental Management
- Low Carbon Energy Use
- Sustainable Systems

**Optional modules**
Three optional modules from the following (subject to change)
- Air Quality and Climate
- Catchment Protection Field Course
- Climate Change and Society
- Data Assimilation and Integration
- Energy Conversion
- Environmental Auditing
- Environmental Radioactivity
- Food Security, Agriculture and Climate Change
- Geoinformatics
- International Environmental Law
- Numerical skills
- Perspectives on Environment and Development
- Renewable Energy
- The Nuclear Engineering Environment
MSc in Environmental and Biochemical Toxicology

Director of Studies
Professor Frank Martin.

Duration
12 months full-time, 24 months part-time.

Entry requirements
Upper second class honours degree, or its equivalent in a relevant subject. We can also consider applicants with a lower second class (or equivalent) if they have relevant work experience (including voluntary work).

IELTS
6.5 or equivalent.

Assessment
Coursework, presentations, examinations and dissertation.

Further information
www.lancaster.ac.uk/lec/postgraduate/taught-masters

Environmental and Biochemical Toxicology are disciplines that underpin a vast array of services. There is a recognised shortage of qualified scientists in such areas; a fact highlighted both by academic societies and industry.

This MSc provides you with an appreciation of the underlying principles of how chemicals adversely affect living organisms. This includes appreciating the diverse applications of toxicology, from identifying mechanisms through to hazard assessment, and understanding the effects on human health, in terms of biotransformation, mutation and neurological impairments.

We also emphasise practical experience gained through the use of cutting-edge techniques in research laboratories. You will also learn general scientific skills in hypotheses testing, problem solving, dealing with scientific literature, and experimental design and rigour.

After finishing this course you will be ready to enter consultancy or industry or to progress to PhD study.

Core modules
- Consequences of Toxic Effects
- Dissertation Project
- Toxicological Mechanisms and Measurements

Optional modules
Four optional modules from the following (subject to change)
- Behaviour of Pollutants in the Environment
- Biological Effects of Air Pollution and Climate Change
- Cell Biology Research Skills
- Chemical Risk Assessment
- Clinical Trials
- Contaminated Land and Remediation
- Data Analysis and Interpretation
- Data Assimilation and Integration
- Disaster Management
- Disease of the Brain
- Drug Development (from concept to clinic)
- Environmental Epidemiology
- Environmental Radioactivity
- Environmental Sampling and Analysis for Trace Organics
- Environmental Toxicology
- Fundamental Research Skills
- Genomics – technologies and analyses of its data
- Immunology
- Microbes and Disease
- Models of Disease and Ageing
- Molecular Basis of Cancer
- Molecular Biology Research Skills
- Numerical Skills
- Pollution Microbiology
- Principles of Epidemiology
- Safety and Environmental Impact Assessment: an Industrial Perspective
Taught programmes (continued)

MA/MSc/PgCert in Environment and Development

Director of Studies
Dr Yani Najman.

Duration
12 months full-time, 24 months part-time.

Entry requirements
Upper second class honours degree, or its equivalent, in a relevant subject. We can also consider applicants with a lower second class (or equivalent) if they have relevant work experience (including voluntary work).

IELTS
6.5 or equivalent.

Assessment
Coursework, presentations and a dissertation.

Further information
www.lancaster.ac.uk/lec/postgraduate/taught-masters

The need for sustainable development is a global concern. This scheme aims to prepare you to address the challenges faced in safeguarding the planet's ecosystems while improving the environments of impoverished communities.

You can take either the MA or MSc pathway, depending on your choice of dissertation topic. Topics are offered in both environmental and developmental themes, with options for fieldwork in the UK, Asia, Africa and South America, usually working with universities and NGOs in the host countries. This optional overseas component provides vital experience for those looking for a career in the overseas development sector.

The scheme has a broad choice of optional modules, combined with the specialisation of the dissertation project. Together these provide the ideal education for anyone interested in a career that will address environment and development issues, in the private, public, or not-for-profit sectors.

The PgCert provides an opportunity for postgraduate learning and professional development for those who are unable to commit to a full Masters programme. The award requires the successful completion of four 15 credit modules, selected from the modules available on the MA/MSc course.

Core modules
- Dissertation Project
- Perspectives on Environment and Development
- Research Methods (for MA stream only)

Optional modules
Four/five optional modules from the following (subject to change)
- Air Quality and Climate
- Behaviour of Pollutants in the Environment
- Biological Effects of Air Pollution and Climate Change
- Catchment Protection (field course)
- Chemical Risk Assessment
- Climate Change and Society
- Consequences of Toxicological Effects
- Conservation Biology
- Contaminated Land and Remediation
- Crop Protection
- Data Analysis and Interpretation
- Data Analysis and Programming Skills
- Data Assimilation and Integration
- Ecology, Conservation and Culture
- Environment and Culture
- Environmental Auditing
- Environmental Justice
- Environmental Management
- Environmental Radioactivity
- Environmental Sampling and Analysis for Trace Organics
- Environmental Toxicology
- Flood Forecasting and Flood Risk Management
- Food Security, Agriculture and Climate Change
- Food Security and Environmental Issues in China
- Geoinformatics
- Geological Hazards
- Globalisation and Democratisation
- Groundwater Resources and Protection
- Habitat Management
- International Environmental Law
- Lake Ecology
- Low Carbon Energy Use
- Modelling Environmental Processes
- Numerical Skills
- Pollution Microbiology
- Right to Adequate Food as a Human Right
- Sustainable Soil Management
- Sustainable Systems
- The Rights of Peoples
- Toxicological Mechanisms and Measurements
- Using the NVC
- Wildlife Monitoring Techniques
- Wildlife Population Ecology
MA/MSc in Environment, Culture and Society

Director of Studies
Dr Saskia Vermeylen.

Duration
12 months full-time, 24 months part-time.

Entry requirements
An upper second class honours degree, or its equivalent. We can also consider applicants with a lower class honours degree, or equivalent, if they have relevant work experience (including voluntary work).

IELTS
6.5 (with a minimum of 5.5 in each element) or equivalent.

Assessment
Coursework and a dissertation. Some optional modules may feature exams.

Further information
www.lancaster.ac.uk/lec/postgraduate/taught-masters

This is a joint degree between LEC and the Department of Sociology. You choose between an MA or MSc pathway from a selection of social and natural science modules. Please also see the entry under Sociology on page 97.

This innovative interdisciplinary course is aimed at those who want to engage critically, practically and creatively with global environmental problems. Issues such as food security, climate change, emergent risks and energy demands, require novel solutions from academic, NGO, business and government sectors.

The course brings together vital insights from social and natural sciences, and draws on cutting edge social, cultural and environmental theory.

Our staff have strong links with a range of scientific, policy, industrial and civic communities, which provide excellent opportunities for placements to gain practical experience. The combination of critical theory, experimental natural sciences and access to real-world contexts creates a unique course for anyone seeking to add value to their academic and/or applied career trajectory.

Core modules
- Dissertation Project
- Environment and Culture
- Interdisciplinarities: Environment, Culture and Society
- Research Methods
- Researching Technoscience

Optional modules
- Three optional modules from the following (subject to change)
  - Capitalism and Crisis
  - Climate Change and Society
  - Ecology, Conservation and Culture
  - Environmental Auditing
  - Environmental Management
  - Food Security, Agriculture and Climate Change
  - Geoinformatics
  - Geological Hazards
  - Habitat Management
  - International Environmental Law
  - Modelling Environmental Processes
  - Perspectives on Environment and Development
  - Policy, Publics and Expertise
  - Science, Technology and Society
  - Social and Cultural Theory
  - Wildlife Monitoring Techniques

Key fact
Coming soon – a new PgCert in Flood and Coastal Management. Please see www.lancaster.ac.uk/lec/postgraduate/cpd--short-courses for further details.
Ma in Environmental Management and Consultancy

Director of Studies
Dr Nigel Watson.

Duration
12 months full-time, 24 months part-time.

Entry requirements
Upper second class honours degree, or its equivalent, in a relevant subject. We can also consider applicants with a lower second class (or equivalent) if they have relevant work experience (including voluntary work).

IELTS
6.5 or equivalent.

Assessment
Coursework, presentations, examinations and dissertation.

Further information
www.lancaster.ac.uk/lec/postgraduate/taught-masters

Whether it is the boardrooms of multinational corporations or the offices of small enterprises the environment is now a fundamental part of decision making. In an increasingly complex and competitive business environment, managers need to understand the commercial opportunities that the environmental sector offers, as well as the standards of performance which customers, shareholders and regulatory agencies now expect.

The MA in Environmental Management and Consultancy prepares you for these challenges. It will develop your skills in decision making, specialist environmental knowledge, and the ability to solve problems in real-world situations.

There are core modules in environmental management and environmental auditing and a wide range of optional modules. A core module in environmental law is provided by the internationally renowned Lancaster University Law School.

The programme also includes a six month research placement where you will have the opportunity to put your knowledge and skills to the test by working for a small-medium sized company, a public sector body or voluntary sector organisation.

Core modules
- Dissertation Project (with Placement)
- Environmental Auditing
- Environmental Management
- International Environmental Law
- Research Methods (unless a social science research methods course has been taken at UG level)

Optional modules
Two or three optional modules from the following (subject to change)
- Air Quality and Climate
- Behaviour of Pollutants in the Environment
- Catchment Protection (field course)
- Chemical Risk Assessment
- Climate Change and Society
- Conservation Biology
- Contaminated Land and Remediation
- Ecology, Conservation and Culture
- Environment and Culture
- Environmental Radioactivity
- Flood Forecasting and Flood Risk Management
- Food Security, Agriculture and Climate Change
- Geoinformatics
- Geological Hazards
- Groundwater Resources and Protection
- Habitat Management
- Low Carbon Energy Use
- Numerical Skills
- Perspectives on Environment and Development
- Renewable Energy
- Right to Adequate Food as a Human Right
- Sustainable Soil Management
- Sustainable Systems

Tom Wright
MA Environmental Management and Consultancy

Lancaster Environment Centre's Environmental Management and Consultancy course gave me the opportunity to complete two periods of work experience with SMEs in the North West as part of my Masters Degree, as well as another separate piece of extracurricular project work for another company through LEC’s Enterprise and Business Partnerships team.

I chose to study at Lancaster for this reason, as the course offered structured work experience for which I could receive detailed feedback, real-world consultancy experience and an entry on my CV. The clients I worked for had real projects which were vital to their businesses, and being able to work on them and add value to these businesses while gaining practical consultancy experience at the same time I believe was invaluable, and has led to me securing employment with a North West based Consultancy.

Faculty of Science and Technology – Lancaster Environment Centre
**MSc/PgCert in Environmental Science and Technology**

**Director of Studies**  
Professor Kirk T Semple.

**Duration**  
12 months full-time, 24 months part-time.

**Entry requirements**  
Upper second class honours degree, or its equivalent, in a relevant subject. We can also consider applicants with a lower second class (or equivalent) if they have relevant work experience (including voluntary work).

**IELTS**  
6.5 or equivalent.

**Assessment**  
Coursework, presentations, examinations and dissertation.

**Further information**  
[www.lancaster.ac.uk/lec/postgraduate/taught-masters](http://www.lancaster.ac.uk/lec/postgraduate/taught-masters)

Increasingly, novel technologies such as informatics, sensor networks, imaging techniques and pollution remediation technologies are impacting the way we view and manage the environment. This scheme explores these issues and offers you a broad range of options allowing you to choose your area of focus.

As well as gaining knowledge in one or more areas of environmental science and technology, you will also develop skills in statistics and computing. Graduates will typically find themselves working for consultancies, government organisations or going on to study for a PhD.

There is also a two-year full-time International MSc (Research) in Environmental Science and Technology, which additionally includes a 12 month overseas research placement.

The PgCert provides an opportunity for postgraduate learning and professional development for those who are unable to commit to a full MSc programme. The award requires the successful completion of four 15 credit modules, selected from the modules available on the MSc course.

**Core module**  
- Dissertation Project

**Optional modules**  
Six optional modules from the following (subject to change)
- Air Quality and Climate
- Behaviour of Pollutants in the Environment
- Biological Effects of Air Pollution and Climate Change
- Catchment Protection (field course)
- Chemical Risk Assessment
- Consequences of Toxic Effects
- Contaminated Land and Remediation
- Crop Protection
- Data Analysis and Interpretation
- Data Analysis and Programming Skills
- Data Assimilation and Integration
- Environmental Applications of Isotope Geochemistry
- Environmental Radioactivity
- Environmental Sampling and Analysis for Trace Organics
- Environmental Toxicology
- Flood Forecasting and Flood Risk Management
- Food Security, Agriculture and Climate Change
- Geoinformatics
- Geological Hazards
- Groundwater Resources and Protection
- Lake Ecology
- Modelling Environmental Processes
- Numerical skills
- Physical Volcanology
- Pollution Microbiology
- Renewable Energy
- Sustainable Soil Management
- Toxicological Mechanisms and Measurements
- Wildlife Monitoring Techniques

**MSc in International Innovation (Environmental Science)**  
Please see the Management School entry on page 148 for information.
Taught programmes (continued)

MSc in Resource and Environmental Management

Director of Studies
Dr Nigel Watson.

Duration
12 months full-time, 
24 months part-time.

Entry requirements
Upper second class honours degree, or its equivalent, in a relevant subject. We can also consider applicants with a lower second class (or equivalent) if they have relevant work experience (including voluntary work).

IELTS
6.5 or equivalent.

Assessment
Coursework, presentations, examinations and dissertation.

Further information
www.lancaster.ac.uk/lec/postgraduate/taught-masters

The management of land, air, water and other resources for sustainable development is a major challenge for the twenty first century. This very popular and vocationally relevant scheme will provide you with an in-depth critical understanding of the key management issues and challenges, as well as developing your problem-solving skills and practical knowledge for future employment in the environmental field.

You will also have the option of taking a six month research placement with a private sector company, government body or voluntary sector organisation as an alternative to a traditional dissertation.

Core modules
- Dissertation Project
- Environmental Management
- Geoinformatics
- Research Methods

Optional modules
Three optional modules from the following (subject to change)
- Climate Change and Society
- Ecology Conservation and Culture
- Environmental Auditing
- Environment and Culture
- International Environmental Law
- Perspectives on Environment and Development
- Right to Adequate Food as a Human Right

MSc/PgCert Sustainable Agriculture and Food Security

Director of Studies
Dr Ian Dodd.

Duration
12 months full-time, 
24 months part-time.

Entry requirements
Upper second class honours degree, or its equivalent, in a relevant subject. We can also consider applicants with a lower second class (or equivalent) if they have relevant work experience (including voluntary work).

IELTS
6.5 or equivalent.

Assessment
Coursework, presentations, examinations and dissertation.

Further information
www.lancaster.ac.uk/lec/postgraduate/taught-masters

With the world’s population fast approaching seven billion, one of the main challenges facing the human race is how to feed its people. It’s estimated that a rise in food production of at least 50% will be needed by 2030, yet society expects that this additional food be delivered with reduced environmental impact.

Food production itself is only part of the problem. Food security isn’t just about exploiting scientific and technological advances to increase crop yields it’s also about addressing the associated economic and social factors to enable people to access sufficient, safe and nutritious food.

This scheme aims to train the next generation of natural and social scientists who will tackle these challenges. It will give you the necessary interdisciplinary training and research with an international focus.

There is also a two-year full-time International MSc (Research) in Sustainable Agriculture and Food Security, which additionally includes a 12 month overseas research placement.

The PgCert provides an opportunity for postgraduate learning and professional development for those who are unable to commit to a full MSc programme. The award requires the successful completion of four 15 credit modules, selected from the modules available on the MSc course.
Core modules

- Crop Protection
- Dissertation Project
- Food Security, Agriculture and Climate Change
- Sustainable Soil Management

Optional modules

Three optional modules from the following (subject to change):

- Behaviour of Pollutants in the Environment
- Biological Effects of Air Pollution and Climate Change
- Catchment Protection (field course)
- Conservation Biology
- Contaminated Land and Remediation
- Data Analysis and Interpretation
- Environmental Management
- Habitat Management
- Numerical Skills
- Perspectives on Environment and Development
- Pollution Microbiology
- Right to Adequate Food as a Human Right
- Sustainable Systems
- Using the NVC
- Wildlife Monitoring Techniques
- Wildlife Population Ecology

IELTS

6.5 or equivalent.

Assessment

Coursework, presentations, examinations and dissertation.

Further information

www.lancaster.ac.uk/lec/postgraduate/taught-masters

This scheme combines modules in hydrology, water quality and ecology with a research project tailored towards developing skills relevant to a career in the water sector, either in the UK, mainland Europe or internationally.

You will be taught by world experts in the field, including staff from the Centre for Ecology and Hydrology (within the Lancaster Environment Centre) and industry leader JBA Consulting. Your specialised project will benefit from our strong research links with organisations such as Dŵr Cymru Welsh Water, United Utilities, JBA Consulting, the Environment Agency, Defra and the UK Government Research Councils. Some projects involve placements within the organisations.

As an MSc SWM student you become an associate member of the LEC Water and Soil Sciences Group and are invited to all of our research and social activities.

The PgCert provides an opportunity for postgraduate learning and professional development for those who are unable to commit to a full MSc programme. The award requires the successful completion of four 15 credit modules, selected from the modules available on the MSc course.

Core modules

- Dissertation Project

Plus, choose at least four from:

- Catchment Protection (field course)
- Environmental Management
- Flood Forecasting and Flood Risk Management
- Groundwater Resources and Protection
- Lake Ecology
- Modelling Environmental Processes
- One of six modules on river, floodplain and coastal risk management taught by JBA Consulting

Optional modules

Two optional modules from the following (subject to change):

- Behaviour of Pollutants in the Environment
- Conservation Biology
- Contaminated Land and Remediation
- Data Assimilation and Integration
- Environmental Applications of Isotope Geochemistry
- Environmental Auditing
- Environmental Sampling and Analysis for Trace Organics
- Food Security, Agriculture and Climate Change
- Geoinformatics
- Geological Hazards
- Habitat Management
- International Environmental Law
- Perspectives on Environment and Development
- Pollution Microbiology
- Renewable Energy
- Sustainable Soil Management

MSc/PgCert in Sustainable Water Management

Director of Studies
Dr Nick Chappell.

Duration
12 months full-time, 24 months part-time.

Entry requirements

Upper second class honours degree, or its equivalent, in a relevant subject. We can also consider applicants with a lower second class (or equivalent) if they have relevant work experience (including voluntary work).

For more information please go to www.lancaster.ac.uk
**Taught programmes (continued)**

### MSc in Volcanology and Geological Hazards

**Director of Studies**
Dr Hugh Tuffen.

**Duration**
12 months full-time, 24 months part-time.

**Entry requirements**
Upper second class honours degree, or its equivalent, in a relevant subject. We can also consider applicants with a lower second class (or equivalent) if they have relevant work experience (including voluntary work).

**IELTS**
6.5 or equivalent.

**Assessment**
Coursework, presentations, examinations and dissertation.

**Further information**
[www.lancaster.ac.uk/lec/postgraduate/taught-masters](http://www.lancaster.ac.uk/lec/postgraduate/taught-masters)

Volcanoes are an exciting spectacle, but also a major natural hazard that threatens millions worldwide. Research into volcanic behaviour is essential for improved forecasting and hazard mitigation. This unique MSc provides you with training in field, theoretical and laboratory volcanology. We have field visits to study volcanic rocks in the nearby Lake District and a popular optional fieldtrip to Etna.

Taught modules cover the physical processes that generate volcanic and other geological hazards, together with their management. Due to the broad range of optional modules you can also study other types of environmental hazards such as flooding, and pick up useful transferable skills such as geoinformatics or modelling.

You will carry out your dissertation research alongside one of the many internationally recognised experts in LEC. This MSc is ideal preparation for PhD research or work in the environment sector, and is suitable for students with a wide range of first degrees, including Geography, Geology, Environmental Science and Physics.

To encourage breadth in our cohort, we offer students with a less numerate background the chance to develop their mathematical skills through a non-assessed support module designed specifically for Masters students.

**Core modules**
- Dissertation Project
- Geological Hazards
- Physical Volcanology

**Optional modules**
Four optional modules from the following (subject to change)
- Air Quality and Climate
- Chemical Risk Assessment
- Climate Change and Society
- Contaminated Land and Remediation
- Data Analysis and Interpretation
- Data Assimilation and Integration
- Environmental Applications of Isotope Geochemistry
- Environmental Management
- Environmental Radioactivity
- Flood Forecasting and Flood Risk Management
- Geoinformatics
- Groundwater Resources and Protection
- Modelling Environmental Processes
- Volcanic Process Field Course

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### MSc (Research) International Masters in Environmental Science and Technology

**Director of Studies**
Dr Hong Li.

**Duration**
21 months full-time.

**Entry requirements**
Upper second class honours degree, or its equivalent, in a relevant subject. We can also consider applicants with a lower second class (or equivalent) if they have relevant work experience (including voluntary work).

**IELTS**
6.5 or equivalent.

**Assessment**
Coursework, presentations, examinations and dissertation.

**Further information**
[www.lancaster.ac.uk/lec/postgraduate/taught-masters](http://www.lancaster.ac.uk/lec/postgraduate/taught-masters)

This is a two-year Masters programme delivered in partnership with the Chinese Academy of Sciences (CAS). It provides training in environmental sciences and its commercial application through world leading research institutions.

In your first year, you will study in Lancaster. You will choose from a range of taught modules in environmental sciences and start a research project, which may be continued in your second year in either China, within the Chinese Academy of Sciences, or the UK. Many of these projects involve collaborations with international commercial organisations and provide excellent work experience in different cultural settings.

Students from all countries are eligible to apply. Graduates will be well placed for an international career in environmental science and technology and further study for a PhD.
Core modules
- Data Analysis and Interpretation
- Dissertation Project (Year 1)
- Extended Dissertation Project (Year 2)

Optional modules
Five optional modules from the following (subject to change)
- Air Quality and Climate
- Behaviour of Pollutants in the Environment
- Biological Effects of Air Pollution and Climate Change
- Catchment Protection (field course)
- Chemical Risk Assessment
- Consequences of Toxic Effects
- Contaminated Land and Remediation
- Crop Protection
- Data Analysis and Programming Skills
- Data Assimilation and Integration
- Environmental Applications of Isotope Geochemistry
- Environmental Radioactivity
- Environmental Sampling and Analysis for Trace Organics
- Environmental Toxicology
- Flood Forecasting and Flood Risk Management
- Food Security, Agriculture and Climate Change
- Geoinformatics
- Groundwater Resources and Protection
- Lake Ecology
- Modelling Environmental Processes
- Numerical Skills
- Physical Volcanology
- Pollution Microbiology
- Renewable Energy
- Sustainable Soil Management
- Toxicological Mechanisms and Measurements
- Wildlife Monitoring Techniques

MSc (Research) International Masters in Sustainable Agriculture and Food Security

Director of Studies
Dr Ian Dodd.

Duration
24 months full-time.

Entry requirements
Upper second class honours degree, or its equivalent, in a relevant subject. We can also consider applicants with a lower second class (or equivalent) if they have relevant work experience (including voluntary work).

IELTS
6.5 or equivalent.

Assessment
Coursework, presentations, examinations and dissertation.

Further information
www.lancaster.ac.uk/lec/postgraduate/taught-masters

With the world’s population fast approaching seven billion, one of the main challenges facing the human race is how to feed its people. It’s estimated that a rise in food production of at least 50% will be needed by 2030, yet society expects that this additional food be delivered with reduced environmental impact.

Food production itself is only part of the problem. Food security isn’t just about exploiting scientific and technological advances to increase crop yields; it’s also about addressing the associated economic and social factors to enable people to access sufficient, safe and nutritious food.

This two year scheme is delivered in partnership with one of our overseas research partners, at universities in China, Brazil, USA, or India. Students will study at Lancaster University for the first year and develop plans for a collaborative project overseas for the second year.

This scheme will provide you with significant experience in food security and sustainable agriculture, its commercial application and experience of directed study and independent research in leading institutions in both the UK and overseas.

Core modules
- Dissertation Project (Year 1)
- Extended Dissertation Project (Year 2)
- Crop Protection
- Food Security, Agriculture and Climate Change
- Sustainable Soil Management

Optional modules
Three optional modules from the following (subject to change)
- Behaviour of Pollutants in the Environment
- Biological Effects of Air Pollution and Climate Change
- Catchment Protection (field course)
- Conservation Biology
- Contaminated Land and Remediation
- Data Analysis and Interpretation
- Environmental Management
- Habitat Management
- Numerical Skills
- Perspectives on Environment and Development
- Pollution Microbiology
- Right to Adequate Food as a Human Right
- Sustainable Systems
- Using the NVQ
- Wildlife Population Ecology
- Wildlife Monitoring Techniques
The Mathematics and Statistics Department is an internationally recognised research and teaching facility. In the 2008 Research Assessment Exercise we submitted the fifth largest research group to the panel for statistics and operations research. 60% of our research output was judged to be world leading or internationally excellent while in the pure mathematics assessment, 50% of our research activity was judged to be world leading or internationally excellent.

We have many established research links with business, industry and government, providing expertise in pure mathematics, statistics, medical statistics and social statistics. Several companies visit us each year to promote the recruitment of our graduates and we have an excellent reputation for graduate employment success. We are also part of the North-West Hub for Trial Methodology Research.

Our BREEAM award winning building was opened in 2008 and comprises dedicated teaching, learning, computing and research facilities for all our postgraduate students. The Department is also a founder member of several national PhD training consortiums in statistics, social statistics, mathematics and operational research.

In 2010, the Department was awarded substantial funding to develop a unique Centre for Doctoral Training (STOR-i) combining statistics, operational research and industrial applications (see page 24). We are producing a new generation of researcher, capable of creating an impact in these complementary areas. This Centre has fully funded 40 students between 2010 and 2013, and is due to fully fund at least 60 further students entering the Centre for Doctoral Training in 2014 – 2019. We are also part of the North West Doctoral Training Centre (NWDDC) and offer a pathway of study in Social Statistics (please see our PhD listings on page 206).

The research community within our Department has an international flavour, including staff and research students from Europe, Asia, Africa, North and South America and Australasia.

Key fact

The Department’s excellent performance is reflected by its outstanding position in both The Complete and Guardian Good University Guides, 2014 which ranked Maths as 10th in the UK.

Dennis Prangle
PhD in Statistics

After several years working in industry, I decided that the most interesting part of my job was using my mathematical skills to investigate statistical problems and began to consider a career change. The good reputation of its MSc in Statistics led me to choose to study at Lancaster, and I found it a rewarding and sometimes challenging experience that left me well equipped with the theoretical and practical tools for a career in statistics. I was impressed by the expertise, facilities and friendliness of the department, and it felt natural to stay on for a PhD.
Research degrees

PhD in Statistics

PhD in Mathematics

Entry requirements
Upper second class honours degree, or its equivalent, in Mathematics, Statistics, or a combination of the two.

IELTS
6.5 or equivalent.

Assessment
Original research and thesis.

Further information
www.lancaster.ac.uk/maths

The Department has the largest cohort of statistics PhD students in the UK, and offers excellent support. Students have a formal weekly meeting with their supervisor, but in most cases this is supplemented by more frequent, informal contact.

Any skills gaps will be covered through additional lecture programmes or directed reading, and students have the opportunity to attend graduate lectures on topics of current research interest, national APTS and MAGIC schemes which provide PhD level courses, and take part in internal seminars for students and staff.

These are an ideal opportunity to gain valuable experience of communicating ideas to an audience while also receiving feedback, which can help set future research directions.

All PhD students have their own departmental laptop, and are generously supported to attend and present work at national and international conferences. Proposals are accepted in any areas of interest to the department.

Research degrees

- PhD in Statistics
- PhD in Mathematics
- PhD in Applied Social Statistics (NWDTC)

Integrated degrees (1+3)

- MSc in Quantitative Methods for Science, Social Science and Medicine
- MRes/PhD in Statistics and Operational Research with Industrial Applications STOR-i

Taught programmes

- MSc in Data Science
- MSc/PgDip in Statistics
- MSc/PgDip/PgCert in Quantitative Methods for Science, Social Science and Medicine

Number of postgraduate students
60

Head of Department
Dr Andrey Lazarev

Postgraduate enquiries
Tel: +44(0)1524 593063
Email: p.neal@lancaster.ac.uk
www.lancaster.ac.uk/maths
Research degrees (continued)

PhD in Applied Social Statistics (NWDT)

Director of Studies
Professor Brian Francis.

Duration
Three years full-time (PhD), four years full-time (MSc/PhD). Part-time study is also possible.

Entry requirements
Upper second class honours degree, or its equivalent, in Statistics, Social Science or a relevant related discipline, or relevant professional qualification or experience.

IELTS
6.5 or equivalent.

Assessment
Original research and thesis.

Further information
www.lancaster.ac.uk/maths and www.nwdtc.ac.uk

This scheme, delivered by the North West Doctoral Training Centre, draws upon the acknowledged strengths of Social Science and Social Statistics at the University, with the balance between the statistics and substantive components of the research tailored to the individual student's interests and background.

Via the doctoral programme, there is provision for joint supervision by the Department and a Social Science or other related department across the three North-West universities (Lancaster, Liverpool and Manchester), increasing the scope and potential focus of your research.

PhD topics currently being studied in this programme include: the development of social network models for understanding the delinquency of teenage gangs; user behaviour of social news websites; changing attitudes to gender roles; long term reconviction behaviours of sex offenders; modelling sentencing outcomes in England and Wales; methods for measuring health outcomes in children including reliability and validity; care pathways of looked-after children; and, factors associated with smoking among school-going male adolescents.

The programme is suitable for a wide range of purposes, notably:
Social Science graduates interested in quantitative empirical work;
Physical Science and Engineering graduates seeking social science conversion opportunities which make maximum use of their existing skills;
Statistics graduates wishing to develop applicable expertise in social statistics;
graduates from any discipline wishing to undertake Advanced Quantitative Training.

For those not ready to embark directly on PhD study, there is an option of beginning with the MSc in Quantitative Methods for Science, Social Science and Medicine before progressing to the PhD (please see Taught programmes).

Our research interests

Statistics: the Statistics Group is interested in the development of novel statistical models and methods motivated by applied problems, with particular emphasis on environmental, biomedical and social sciences. Methodological strengths include change point methods, computationally intensive methods, design and analysis of clinical trials, epimedic modelling, extreme value methods, locally stationary processes, longitudinal models, spatial statistics, spatial genetics, stochastic modelling, survival analysis and time series modelling.

There is a strong emphasis on the interface between theory and application, and the group has close research links with other University departments, government departments and research institutes, a wide range of industries including multinationals and SMEs, hospitals, pharmaceutical companies within the UK and overseas.

Pure Mathematics: the research interests of staff are broad and cover many areas of Analysis, Algebra and Combinatorics. There is also research at the interfaces between Algebra, Geometry and Rigidity Theory.

Specific topics include Group Theory, Graph Theory, Representation Theory, Homological Algebra, Algebraic Topology, Lie Theory, Lie Algebras, Quantum Algebra, Quantum Field Theory, Mathematical Physics, Operator Algebras, Spectral Theory, Probability and Discrete Geometry. The section also has strong connections with groups in other European countries, North America and India.

Key fact

Approximately two thirds of STOR-i projects will have direct industrial involvement with joint supervision provided by an industrial collaborator, visits to their research teams, and a genuine insight into industry research.
**Integrated degrees (1+3)**

**MSc in Quantitative Methods for Science, Social Science and Medicine**

If you secure NWDTC funding, there is an option of taking the MSc in Quantitative Methods for Science, Social Science and Medicine in year one before progressing to the full PhD. Please contact the department for further details of this option.

**MRes/PhD in Statistics and Operational Research (in partnership with industry) with Industrial Applications (STOR-i)**

**Director of Studies**
Professor Jonathan Tawn.

**Duration**
4 years full-time.

**Entry requirements**
First class honours degree, or its equivalent, in an undergraduate course with a substantial mathematical content.

**IELTS**
6.5 or equivalent.

**Assessment**
MRes: coursework and exam; PhD: original research and thesis.

**Further information**
www.stor-i.lancs.ac.uk

The programme begins with an MRes, which provides a robust grounding in the field and the development of key research skills. You will then identify a research topic and plan your PhD research. You will also develop a versatile skill set including: advanced problem solving, programming, and teamwork, plus, a broad range of presentation and dissemination skills.

The remaining three years will be spent working on the PhD project guided by appropriate supervisory teams, whilst taking a wide range of specially devised training programmes and experiencing extended international research visits at world leading universities to increase your employability. All PhD students get experience of researching with industry, as 80% of students have a PhD project co-funded and co-supervised by industry and the rest have a six month industrial internship.

**Compulsory modules**
- Training for Research and Industry
- Probability and Stochastic Processes
- Optimisation
- Likelihood Inference
- Computer Simulation
- Bayesian Inference
- Computational Intensive Methods

**Optional modules**
(PhD – voluntary):
- Leadership and Project Management Training
- Communication Training
- Research Integrity
- Continual Professional Development in Statistics and Operational Research
- Computational Horizons

**Key fact**
Only interested in the module relating to teaching statistics? You can opt for a PgCert as a part-time certificate, which is ideal for university lecturers or teachers in secondary education.
**Taught programmes**

**MSc in Data Science**
Please see entry under the School of Computing and Communications on page 180.

**MSc/PgDip in Statistics**
**Director of Studies**
Dr Deborah Costain.

**Duration**
MSc: 12 months full-time or 24 months part-time.
PgDip: nine months full-time.

**Entry requirements**
Second class honours degree, or its equivalent, in a subject with a strong Mathematics or Statistics component. Conversion modules are available.

**IELTS**
6.5 or equivalent.

**Assessment**
Coursework, examination and dissertation.

**Further information**
[www.lancaster.ac.uk/maths](http://www.lancaster.ac.uk/maths)

This MSc has a strong theoretical and methodological component to supplement a focus on applications of statistics to real life scientific problems. You can opt to follow pathways in medical, pharmaceutical or environmental statistics, depending on your field of interest. Graduates tend to enter careers as practising statisticians, university research assistants or go on to study for a PhD.

For each pathway you will follow a set of compulsory modules covering core theory and methods, applied statistical modelling and practical skills in topics such as statistical computing, scientific writing, presentation and consultancy. You will also study optional modules tailored to your research interests and career aspirations. Your studies are completed with a supervised in-depth dissertation aimed at solving a substantive research question.

**Compulsory modules**
- Statistics in Practice
- Likelihood Inference
- Generalised Linear Models
- Bayesian Inference
- Computational Intensive Methods

**Optional modules (choose five):**
- Extreme Value Theory
- Clinical Trials
- Principles of Epidemiology
- Genomics: Technologies and Data Analysis
- Longitudinal Data Analysis
- Pharmacological Modelling
- Survival and Event History Analysis
- Environmental Epidemiology
- Adaptive and Bayesian Methods in Clinical Research

**MSc/PgDip in Quantitative Methods for Science, Social Science and Medicine**
**Director of Studies**
Dr Gillian Lancaster.

**Duration**
MSc: 12 months full-time, or 36 months part-time.
PgDip: nine months full-time, or 21 months part-time.

**Entry requirements**
Upper second class honours degree, or its equivalent, in Mathematics, a Social Science or other related discipline, or relevant professional qualification and experience.

**IELTS**
6.5 or equivalent.

**Assessment**
Coursework, examination, in depth dissertation.

**Further information**
[www.lancaster.ac.uk/maths](http://www.lancaster.ac.uk/maths)

We offer a range of pathways for this MSc/PgDip suite of courses. All are designed to provide you with a solid foundation in the theory and application of statistical methods for the natural, social and health sciences.

You study substantive theory, research methods, data collection (including how to use data from large government social surveys) and statistical analysis (including software packages R, SPSS and STATA) and explore the application of this knowledge in a range of areas. Modules are taught in short intensive blocks, making this programme ideal for part-time study.
The specialist pathways offered are Scientific Research Methods, Crime and Social Statistics, Statistical Methods for Health Research, Teaching Statistics (based on your choice of optional modules).

**Compulsory modules**
- Statistical Inference
- Sampling Design
- Questionnaire Design
- Secondary Data Analysis
- Statistical Inference
- Generalised Linear Models
- Secondary Data Analysis
- Multi-Level Models

**Optional modules**
(May vary from year-to-year)
- Bayesian Methods
- Duration (Survival) Analysis
- Methods for Missing Data
- Data Mining Techniques
- Structural Equation Modelling
- Event History Analysis
- Clinical Trials
- Principles of Epidemiology
- Statistics in Practice
- Quantifying and Evaluating Forensic Evidence
- Quantitative Criminology
- Teaching Statistics

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**PgCert in Quantitative Methods for Science, Social Science and Medicine**

**Director of Studies**
Dr Gillian Lancaster.

**Duration**
12-24 months part-time.

**Entry requirements**
Upper second class honours degree, or its equivalent, in Mathematics, a Social Science or other related discipline, or relevant professional qualification and experience.

**IELTS**
6.5 or equivalent.

**Assessment**
Coursework.

**Further information**
[www.lancaster.ac.uk/maths](http://www.lancaster.ac.uk/maths)

This Postgraduate Certificate can be obtained by successfully completing an approved combination of taught modules or, alternatively, the stand alone distance learning module in Teaching Statistics.

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**Professor Paul Fearnhead**
Department of Mathematics and Statistics

*The distinctive feature of statistics research at Lancaster is that methodological innovations are motivated by, and fed back into, substantive applications in the natural, biomedical and social sciences. We have particular strengths in computational statistical methods; longitudinal data analysis and extreme value theory.*

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For more information please go to [www.lancaster.ac.uk](http://www.lancaster.ac.uk)
Physics

In the active and vibrant research-led environment of the University, Physics has 48 academic members of staff, 52 research staff, and over 90 postgraduate students from a wide variety of countries.

Research is concentrated on the experimental and theoretical aspects of Cosmology, Condensed Matter Physics, Particle Physics, Advanced Materials Nanoscience and Mathematical Physics. It is supported by 142 current research grants totalling over £22.2m. There are numerous funded collaborations with overseas laboratories, as well as major European networks and Department members have been awarded several prestigious prizes and fellowships.

We pride ourselves on our research facilities. Experimental research in Elementary Particle Physics has access to the accelerators at Fermilab (USA) and the new large Hadron Collider (LHC) at CERN (Geneva). There are leading European Facilities at the Ultra-Low Temperature Laboratory (ULT) allowing experiments to be performed over the millikelvin and microkelvin range through liquid 4He and 3He. Dilution refrigerators and nuclear demagnetisation to well below 100k are all available as well as high magnetic fields from superconducting solenoids (up to eight Tesla).

We have state of the art molecular beam epitaxy facilities and specially equipped labs for III-V semiconductor nanostructures and devices. Characterisation facilities include a field-emission-gun SEM with e-beam lithography, x-ray diffraction, picosecond lasers covering visible and mid-IR range, photo and electro-luminescence in magnetic fields and unique nanomechanical and nanothermal scanning probe microscopy suite.

Computing facilities include Linux workstations and a dedicated Grid computing facility as well as a £1.1m Beowulf class computer. Fast network links allow the use of regional and national supercomputers and many of the experimental facilities have online computer links for control and data acquisition.

Students can access all this and take advantage of our international connections to spend time working at a range of labs in Europe, USA and Japan. Socrates placements are also available.

Professor George Pickett
Professor of Physics and Fellow of the Royal Society

Postgraduate study at Lancaster will introduce you to the international nature of today’s physics research. We participate in several EU networks and collaborations with groups worldwide, including particle physics experiments at CERN (Geneva), Fermilab (US) and Kamioka/Tokai (Japan). In 2009 the Microkelvin Laboratory was designated a European Facility.
Research degrees

PhD in Physics

Entry requirements
Upper second class BSc or MPhys honours degree, or its equivalent, in a relevant subject.

IELTS
6.5 or equivalent (lower grade admissions may be possible via separate pre-sessional English courses).

Assessment
Original research and thesis.

Further information
www.lancaster.ac.uk/depts/physics

We welcome applications from those seeking to perform research for the degree of PhD. Research opportunities are available within each of our research areas concentrated within the broad areas of Elementary Particle Physics and Cosmology, and Condensed Matter Physics. It covers both theoretical and experimental aspects, grouped under Elementary Particle Physics, Condensed Matter Physics, and Theoretical Physics.

There is vigorous cross-divisional activity, which includes studies of new materials such as graphene and molecular nanowires, cosmological experiments in liquid helium, nonlinear dynamics of biological rhythm and IR spectroscopy and nanoscale probe microscopy of biological objects.

Key fact
We are top of the table in the UK (RAE 2008). We also received the highest possible 5* rating in the 2001 Research Exercise, and rank in the top 10 for student satisfaction.

Key fact
Microkelvin Physics at Lancaster was recently recognised by ISI Essential Science Indicators as the most prolific experimental group in superfluidity worldwide. Our nuclear refrigeration is arguably the best in the world.

Research degrees
- PhD in Physics
- PhD in Nanoscience
- MSc by Research in Physics

Head of Department
Professor Peter N Ratoff

Head of Research
Professor V I Falko

Director of Postgraduate Studies
Dr Oleg Kolosov

Deputy Director of Postgraduate Studies
Dr Jaroslaw Nowak

Postgraduate enquiries
Sandra Irving
Tel: +44(0)1524 592067
Email: physics-postgrads@lancaster.ac.uk
www.physics.lancs.ac.uk/study_here/postgraduate
Research degrees (continued)

PhD in Nanoscience
Entry requirements
Upper second class BSc or MPhys degree in Physics, or its equivalent, in a relevant subject.
IELTS
6.5 or equivalent.
Assessment
Original research and thesis.
Further information
www.lancaster.ac.uk/depts/physics

Our PhD in Nanoscience offers training by research in several niche areas of Nanoscience and Nanotechnologies which is excelled by the experimentalists in the Quantum Technology Centre and theorists in the Centre for Nanoscale Dynamics at Lancaster.

In experimental nanoscience we offer projects in quantum technologies and development; studies of superconductor and semiconductor qubits and quantum circuits; quantum metrology; development quantum dot systems for quantum key distribution; studies of atomic two-dimensional materials including graphene, boron nitride, hexagonal metal chalcogenides and their heterostructures; development and applications of new scanning mechanical and thermal microscopy techniques; development of novel nanostructured materials for telecommunications and for energy applications. Using Lancaster’s world-leading expertise in cryogenics, we study nanostructures at the record-breaking low temperatures, in a sub-mK range.

In theoretical nanoscience, we offer projects in quantum transport and quantum Hall effect; mesoscopics and fundamentals of nanoelectronics; single-molecule electronics; quantum optics; quantum information processing. We develop theories of new atomic two-dimensional materials using the first principles density functional theory, quantum Monte Carlo modelling, and phenomenological theories. We develop theories of dynamics and kinetics in quantum systems in strongly non-equilibrium conditions using field theory methods. On the side of applied nanoscience, we model devices for electronics and optoelectronic applications.

Our doctoral students get access to the high-end research facilities in Physics: brand new nanofabrication facilities, MBE growth equipment, optical and electronic characterisation instruments, unique ultra-low temperature infrastructure, and high-performance computational facilities. Many of our projects are run in collaboration with world leading innovation companies including Bruker, Fiat, and Oxford Instruments. Research projects on two-dimensional materials are embedded into the wider scope of the European Graphene Flagship project and other collaborations with numerous research groups in Europe. The programme is supported by a selection of taught courses providing skills in modern research techniques, special scientific training and transferable skills courses.

MSc by Research in Physics
Duration
12 months full-time, 24 months part-time.
Entry requirements
Upper second class honours degree, or its equivalent, in a relevant subject.
IELTS
6.5 – lower grade admissions may be possible via separate pre-sessional English courses.
Assessment
Original research and dissertation.
Further information
www.physics.lancs.ac.uk/study_here/postgraduate/masters-by-research

The MSc (by research) in Physics can be started at any time of the academic year, as agreed with your supervisor. You will define and manage an independent research project which will equip you for more sustained and original work at the doctoral level or for advanced level applied research positions in a range of organisations including industry, government and charities.

A feature of this programme is the flexibility required to support learning in a variety of educational and practical research contexts: either on campus or in industry depending on your individual circumstances.
All students will undergo a period of induction into the programme with their project supervisor. This will lead to the completion of a learning plan involving the student and the university, and where applicable an outside organisation. During the period of induction, supervisors will undertake a research training development needs analysis (DNA) and will make you aware of the research training opportunities offered by the Department, Faculty and University, as well as outside training opportunities.

At the end of the third month (full-time) or sixth month (part-time) you will submit a report which will enable your supervisor to offer formative feedback on, for example, your academic writing skills, progress to date and ability to synthesise information.

Finally, you will complete a dissertation based on your research which will be submitted for examination.

Our research interests

Experimental Elementary Particle Physics
The Large Hadron Collider (LHC, CERN): leading the ATLAS B-physics studies, investigating the origin of CP violation; major role in the study of the Higgs decays to tau leptons; studies of the top quark as a probe of new physics signatures; development of computing for ATLAS, and worldwide computing Grids; semiconducting tracking detectors for the high radiation levels in ATLAS, both to predict and minimise the loss of performance of the existing detector and to design a new detector for the ATLAS high-luminosity upgrade; leading the work on the software and computing for the upgrade.

Neutrino Oscillations (JPARC, Japan): CP violation in the neutrino sector; building the downstream module of the electromagnetic calorimeter which is part of the T2K ‘near detector’. Contributing to the research and development efforts on the design of the next generation of experiments at Fermilab and JPARC.

Accelerator Science and Technology (Daresbury, UK): development of new materials for RF cavities; design studies for a polarised positron source for an e+e- linear collider; and theory (with Cockcroft Institute).

The MSc by Research facilitates well focused, bespoke and novel research projects which are ideal for solving specific fundamental or applied physics problems, or for students who wish to gain independent research skills without a three year commitment.

Dr Oleg Kolosov, Reader in Experimental Condensed Matter Physics
Our research interests (continued)

Condensed Matter Physics

Microkelvin Physics: exotic phenomena in superfluid 3He; probing spin and dynamics of superfluid state through NMR; Quasiparticle beam experiments to study unconventional (Andreev) ballistics and quantum turbulence; and cosmological implications of all experiments.

Dynamics and Turbulence: exploring turbulence in the restricted flow of superfluids; studying stochastic resonance (relevant to the ice-age cycle, ring lasers, and sensory neurons) and Brownian ratchets (the nanoscale motors responsible for protein transport in biological cells).

Biomedical Physics: non-linear physics applied to study the function of living systems; understanding oscillatory processes involved in energy transfer within the cardiovascular system and information transfer within the brain; analytical and numerical studies characterising nonlinear oscillatory interactions, tackling problems related to anaesthesia, ageing, cardiac failure, diabetes, hypertension and post-myocardial infarction.

Optoelectronics and Nanostructures: experiments on semiconductor, carbon-nanotube and graphene based optoelectronic and energy materials and devices; quantum dot and phase change memories; graphene based supercapacitors and rechargeable batteries; superconducting tunnel junctions and the development of advanced techniques for nanoscale characterisation of materials, devices and biomaterials; MBE (molecular beam epitaxy) growth of a variety of III-V compounds, with emphasis on mid-infrared (2-5µm) optoelectronics; spectroscopy and scanning probe microscopy (SPM) of quantum structures; and 2D materials; QEMS (quantum nano electro mechanical systems); new instrumental paradigms in nanotechnology by combining SPM with localised chemical fingerprinting, spectroscopic analysis, thermal measurements and ultrasonic imaging.

Theoretical Physics

Condensed Matter Theory: developing fundamental condensed matter theories; studies of new materials; modelling of experimentally investigated devices; 2D electron systems and the quantum Hall effect; strongly correlated one-dimensional quantum systems; electronic properties of graphene and carbon nanotubes; transport and dynamics in molecular electronic systems; theory of quantum dynamical systems; quantum dots, phase-coherent mesoscopic hybrid systems with superconducting, ferromagnetic and normal components, noise and counting statistics; and worldwide collaborations with two dozen experimental nanoscience centres and theory groups.

Particle Theory, Astrophysics and Cosmology: a leading centre for the development of inflationary cosmology and the structure formation in the early Universe; a new initiative in theoretical particle cosmology, string cosmology, and quantum theory of gravity to resolve cosmological and black hole singularities with the intention of making it the leading centre for its study in the UK; and developing insights into beyond the Standard Model physics from observations expected from CERN’s LHC and ESA’s Planck CMB satellite.

Electromagnetism, Geometry and Gravity: developing a fundamental understanding of the behaviour of charged media and their electromagnetic self-fields to be used in future accelerator and intense light source design. We collaborate globally and have a strong interaction with the Cockcroft Institute.
Psychology

Psychological research at Lancaster University is focused around two research centres, which reflect our internationally recognised programmes of research excellence.

The Centre for Research in Human Development and Learning draws together the University’s critical mass of psychologists working on fundamental questions surrounding typical and atypical development and learning from early infancy through to adulthood. Illustrative projects cover topics in: perception and social cognition in infancy; memory development in children; the effect on development of diversity in multicultural environments from social and cognitive perspectives; neurophysiological and neuropsychological markers of cognitive development and ageing; and language and literacy in typically and atypically developing populations.

The Centre is at the forefront of international research in development and learning, combining behavioural, computational, and neuroscientific methods for investigating human behaviour across the lifespan.

The Centre for Cognitive and Social Research comprises two units enabling interactions between cognitive, social and forensic approaches to flourish. The Perception and Embodied Cognition group includes auditory and visual processing in complex environments, the relationship between the body’s actions and perception of the world, representation of time and space, and links between language and sensory systems. The Social Processes group conduct research on, for example, interpersonal trust, automated lie detection, the processes that underpin cooperation and violence, the interpersonal dynamics of crisis negotiations, effects of violent video games, non-conscious goals, the influence of accents on person perception and social categorisation, and attitudes toward people with intellectual disabilities.

Research degrees
- PhD

Taught Programmes
- MSc in Psychological Research Methods
- MSc in Developmental Psychology
- MSc in Developmental Disorders
- MSc in Psychology of Advertising
- MSc in Social Psychology

Number of postgraduate students
100

Head of Department
Professor Charlie Lewis

Postgraduate enquiries
Tel: +44(0)1524 594975
Fax: +44(0)1524 593744
Email: postgraduate.psychology@lancaster.ac.uk
www.psych.lancs.ac.uk
The two Centres offer cutting-edge facilities in their dedicated laboratories. We offer postgraduate research supervision in many topics for which staff have internationally recognised expertise, and which offer the opportunity for students to engage in ground-breaking work in theoretical development and its application. We are especially proud of our impeccable record in guiding our students towards the successful completion of their degrees within a nationally recognised time frame. This reflects the quality of our students and the constructive environment in which they work. We discuss some of the main research themes below, but we recommend that potential applicants contact and interact with specific staff to develop specific research proposals that are likely to be successful.

Members of both Centres also work closely with other departments within the University, particularly Computing and Communications, Linguistics, Economics, Educational Research, Law and Management Science. We welcome cross-cutting, interdisciplinary proposals, which allow research innovation and complementary approaches to be taken.

**Research degrees**

**PhD**

**Entry requirements**
Upper second class honours degree, or its equivalent, in a relevant subject. We often recommend that applicants have a Masters degree as foundational experience for a PhD programme, although this is considered on a case by case basis.

**IELTS**
6.5 or equivalent.

**Assessment**
Original research and thesis.

**Further information**
www.psych.lancs.ac.uk

Much of the research done by postgraduate students is closely connected with staff research projects, and proposals are welcomed from those who share our research interests.

Within our two Centres we draw together multiple perspectives to investigate theoretical and applied topics in psychological research. The themes listed overleaf provide a flavour of research projects currently underway in the Department.

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**Our research interests**

**Centre for Research in Human Development and Learning**

**Developmental Cognitive Neuroscience:** members of this group use neurophysiological and behavioural measures, as well as computational modelling, to investigate development over the lifespan. Areas of investigation include object processing and categorisation, multisensory integration, perception of action and biological motion, development of emotion processing, social cognition and early communication, and psychopharmacology.

**Social and Perceptual Development:** members of this group study social and perceptual processes in infancy and early childhood. Research areas include object perception, spatial perception and navigation, early language acquisition, understanding of pictures and words in children with autism, social understanding in autism, development of empathy, the role of the father in development, markers and rehabilitation in Alzheimer’s and Parkinson’s disease.

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“This Masters degree is a unique opportunity for those who are interested in how psychology can provide insights that drive advertising strategy and to hone their skills and experience in preparation for this career path.”

Rebecca Strong, Psychology of Advertising

Faculty of Science and Technology – Psychology
Language, Memory and Literacy: research in this group addresses vocabulary development and early communication, development of reading and listening comprehension, effects of experience on reading ability, the understanding of adult cognition as an outcome of development, integration across multiple modalities, concept acquisition, the role of sleep in learning, mathematical cognition, working memory and executive functioning.

Centre of Cognitive and Social Research
Perception and Embodied Cognition: research in this group includes auditory and visual processing in complex environments, the relationship between the body’s actions and perception of the world, representation of time and space, and links between language and sensory systems.

Social Processes: members of this group conduct research on, for example, interpersonal trust, automated lie detection, the processes that underpin cooperation and violence, the interpersonal dynamics of crisis negotiations, effects of violent video games, non-conscious goals, the influence of accents on person perception and social categorisation, and attitudes toward people with intellectual disabilities.

Taught programmes

MSc in Psychological Research Methods

Duration
12 months full-time, 24 months part-time.

Entry requirements
Upper second class honours degree in Psychology, or its equivalent, including research design and statistical methods.

IELTS
6.5 or equivalent.

Assessment
Coursework and dissertation.

Further information
www.psych.lancs.ac.uk

This course provides ESRC accredited research training for graduates whose first degree contains a significant component of psychology. It is especially suited to applicants who wish to progress to a PhD, or wish to develop their research skills in preparation for further professional training (e.g. Clinical, Forensic, Educational, Health, Occupational Psychology), or who require additional training in psychological research methods to apply to their work environment.

The course consists of taught modules followed by an independent project supervised by a member of staff and resulting in an MSc dissertation.

Compulsory modules
- Conducting and Presenting Psychological Research
- Statistics for Psychological Research
- Research Dissertation

Optional modules
(Choose two from topics in the following areas, courses vary year-to-year):
- Applied Aspects of Psychology
- Cognitive Psychology
- Developmental Psychology
- Neuroscience
- Social Psychology

For more information please go to www.lancaster.ac.uk
**Faculty of Science and Technology – Psychology**

**Taught programmes (continued)**

**MSc in Developmental Psychology**

**Duration**
12 months full-time, 24 months part-time.

**Entry requirements**
Upper second class honours degree, or its equivalent, in Psychology or a related discipline.

**IELTS**
6.5 or equivalent.

**Assessment**
Coursework and dissertation.

**Further information**
www.psych.lancs.ac.uk

The primary aim of this MSc is to provide you with an advanced knowledge of the methods, analytical techniques, theories and major findings in a range of important sub-areas of developmental psychology. This course provides ESRC accredited training.

You will study compulsory and optional modules that will provide you with foundational theoretical knowledge and skills in research, design and statistics. Examples of optional modules are Cognitive Psychology and Neuroscience. These are delivered through a variety of teaching methods, including: lectures, interactive discussion sessions, direct practical experience of modelling developmental phenomena, and gathering, analysing and presenting developmental data. You will finish with a research dissertation in which you develop your ideas in the context of one to one supervision with a member of the developmental psychology team.

The course is aimed at graduates who wish to progress to a PhD in developmental psychology, or seek to boost their research skills en route to clinical or educational psychology training. It is also designed for graduates who require additional developmental knowledge to apply to their work environment.

**Compulsory modules**
- Conducting and Presenting Psychological Research
- Developmental Psychology
- Research Dissertation
- Statistics for Psychological Research (two modules)

**Optional modules**
(Choose from topics in the following areas, courses vary year-to-year):
- Applied Aspects of Psychology
- Cognitive Psychology
- Developmental Psychology
- Neuroscience
- Social Psychology

This MSc promotes knowledge of developmental psychology with a focus on atypical development across the lifespan. Through taught modules you will acquire advanced knowledge of the theories and major findings in this field, and develop expertise in the methods and analytic techniques used in research. The dissertation is an important component of the course, in which you will develop your own original psychological research project under expert supervision. This course provides ESRC accredited research training.

This course is aimed at graduates wishing to enter an applied or research career in developmental disabilities, and is beneficial for students who wish to progress to a PhD in clinical, educational, or experimental psychology. It is also suited to those who wish to boost their research skills en route to, or after, behavioural therapy or clinical or educational psychology training.

**Compulsory modules**
- Conducting and Presenting Psychological Research
- Developmental Disorders
- Developmental Psychology
- Research Dissertation
- Statistics for Psychological Research

**Optional modules**
(Choose from topics in the following areas, courses vary year-to-year):
- Applied Aspects of Psychology
- Cognitive Psychology
- Developmental Psychology
- Neuroscience
- Social Psychology

**MSc in Developmental Disorders**

**Duration**
12 months full-time, 24 months part-time.

**Entry requirements**
Normally an upper second class honours degree, or its equivalent, in Psychology or a related discipline.

**IELTS**
6.5 or equivalent.

**Assessment**
Coursework and dissertation.

**Further information**
www.psych.lancs.ac.uk
MSc in Psychology of Advertising

Duration
12 months full-time, 24 months part-time.

Entry requirements
Upper second class honours degree, or its equivalent, in Psychology, Advertising, Marketing or any related discipline.

IELTS
6.5 or equivalent.

Assessment
Coursework and dissertation.

Further information
www.psych.lancs.ac.uk

This novel MSc is designed to link psychological research skills and knowledge of human behaviour with the domain of advertising. A major feature of the course is the integration of theory with the practical reality of advertising. As well as developing an understanding of advertising research design, you will undertake dissertation research that applies psychological theory to leading-edge issues in advertising or to real-time commercial needs. This is conducted within an unpaid internship during the summer term with a communications organisation (giving invaluable commercial experience), or within the postgraduate department for more specialised ‘lab based’ experiments. This course provides ESRC accredited training.

During the course, you will experience both academic and practitioner contributions, and will acquire a firm understanding of issues such as:

- How is success predicted by the characteristics of people receiving advertising media as well as the characteristics of those who develop the media? What causes campaigns to fail? How cognitive, social, developmental and neuropsychological factors combine to influence advertising communications, and much more.

- You will be well placed for client or agency opportunities in advertising planning, marketing communications, media planning, digital marketing, brand planning, and qualitative research on graduation.

Compulsory modules
- Advanced Advertising Theory
- Analysing and Interpreting Data
- Analysing Talk and Text
- Dissertation
- Practical Advertising Research and Planning
- Psychological Aspects of Advertising

MSc in Social Psychology

Duration
12 months full-time, 24 months part-time.

Entry requirements
Upper second class honours degree, or its equivalent, in Psychology or in any related discipline.

IELTS
6.5 or equivalent.

Assessment
Coursework and dissertation.

Further information
www.psych.lancs.ac.uk

This course increases your understanding of key theories, methods and findings in Social Psychology. You will learn how to do your own social psychological research and to apply social psychology to solving social problems.

It is aimed at those who wish to progress to a PhD in Social Psychology or wish to boost their research skills en route, or part way through, a career in a related field of inquiry (e.g. education, research or applied social science). Social Psychology is beneficial in a wide range of professions including Civil Service, non-governmental organisations (NGOs), public and voluntary sector agencies, and social science professions.

This course offers a number of options and methodological foci, which give students the flexibility to focus on the areas of social psychology they find most interesting. Students can choose, for example, to concentrate on qualitative social psychology; experimental social psychology; social psychology and language; motivation and emotions.

You will complete core modules in Social Psychology and Conducting and Presenting Psychological Research; two modules of three offered in Quantitative and Qualitative Research Methods; and then pursue a further option towards a particular aspect of Social Psychology, which you may follow up in your research project and dissertation.

Compulsory modules
- Analysis for Psychological Research
- Conducting and Presenting Psychological Research
- Research Dissertation
- Social Psychology

Optional modules
(Choose from topics in the following areas, courses vary year-to-year):
- Applied Aspects of Psychology
- Cognitive Psychology
- Developmental Disorders
- Developmental Psychology
- Neuroscience

For more information please go to www.lancaster.ac.uk