



# Faculty of Engineering and Physical Sciences

## Introduction

The Faculty of Engineering and Physical Sciences covers the core engineering disciplines of aeronautical engineering, civil engineering, chemical engineering, electronic engineering and mechanical engineering alongside the scientific disciplines of computing, mathematics and physics. We have an outstanding reputation for excellence in research and teaching, a strong enterprise culture and an excellent record of graduate employment.

Our academics are well respected, both nationally and internationally, throughout academia and industry where our links are strong. We believe that a university should contribute to the cultural wealth of society by developing the mainstay sciences, while enhancing the technology to improve our overall quality of life.

The Faculty offers a stimulating and supportive environment for those who want to experience the cutting edge of science and technology, and develop their careers in line with these aspirations.

## Facilities and Equipment

Through consistent investment stemming from our deep commitment to develop world-class, sustainable research programmes, the Faculty has built up an impressive infrastructure to support all its activities.

The Faculty can boast state of the art laboratory facilities which provide unique opportunities in many areas. Examples include clean-rooms for the development of nanotechnology, advanced laser facilities, wind tunnels, radiation detection and monitoring laboratories, medical research facilities, a ground-station for monitoring satellites, a centre for ion implantation and ion beam applications, supercomputers for advanced mathematical modelling, a centre dedicated to materials research, facilities for sound and image recording, multimedia laboratories, RF and wireless test facilities and so on. These are fully supported by dedicated teams of technical and IT support staff.

The interdisciplinary nature of much of our work encourages us to constantly explore new opportunities to cross boundaries, providing students with the prospect of accessing facilities which are truly world class.

**“If you really want to work at the cutting-edge, then choosing Surrey will be the best decision you will ever make.”**

Professor Michael J Kearney,  
Dean of Faculty



### Teaching

Our taught Masters programmes are led by our research-active staff who provide a range of learning experiences (lectures, tutorials, directed study, practical laboratories and project work) that prepare graduates for their professional life, be it in the high technology sector, the world of commerce, or elsewhere. We are particularly keen to develop in all our students a broad range of generic skills to complement the core technical or scientific competencies of their chosen subject area. Our modular programme format, coupled with the increasing use of innovative teaching and learning strategies such as e-learning and industrially focused short courses, provides a flexible study environment whilst maintaining the academic rigour and quality expected of one of the UK's top rated Faculties.

There are around 800 students from all over the world currently participating in our Masters programmes. Many programmes can be tailored to suit your own particular needs and interests. Our record of graduate employment is outstanding, with Surrey graduates consistently being in high demand across all sectors.

### Research

Our research takes place predominantly within large, cohesive groups. These groups use our state of the art facilities and provide unique opportunities to pursue a variety of topics. Many of these topics have a multidisciplinary flavour. The quality of our research is widely recognised internationally. In the last Research Assessment Exercise over 70 per cent of the Faculty's research was independently assessed as being either World leading or internationally excellent.

Our research interests range from nuclear physics to interplanetary space exploration. We have an enviable reputation for contributions in areas as diverse as biomedical engineering, mobile communications, aircraft engine and sports car design, non-linear mathematics, materials science, microelectronics and optoelectronics, computer vision and imaging, water purification and desalination, electronic security, environmental strategy, satellite manufacture, spacecraft engineering, ion beams and nanotechnology.

Many of these activities are underpinned by strong industrial links, and several successful spin-out companies have resulted.

### Graduate School

There are more than 600 postgraduate research students studying within the Faculty. We are justifiably proud of our record in postgraduate training and we offer a rich variety of research topics for study. These are delivered through the traditional PhD route and also through our highly successful EngD programmes. Although students are based for their studies within Research Groups and Centres, the Faculty Graduate School coordinates matters and works to ensure that students and staff interact across the Faculty to generate a vibrant intellectual community. The Graduate School also plays a prominent role in creating a friendly social environment.

### Key Facts

- Reputation for excellence in both teaching and research
- Strong enterprise culture
- Excellent record of graduate employment
- State-of-the-art facilities for both research and teaching
- Well-established links with industry, both nationally and internationally



### Research in Engineering and Physical Sciences

Widely recognised internationally for its research, the Faculty consists of over 1000 researchers, of whom 170 are academic staff, 200 are postdoctoral research assistants and the remainder are postgraduate researchers. Our annual turnover of research income is around £16 million, of which about half comes from Research Councils UK (principally EPSRC), a third from the EU and the rest mainly from industry (our largest clients being EADS Astrium, Rolls Royce, E.on, Toyota, AWE and QinetiQ).

The Faculty has an enviable reputation for the contributions it has made in areas that range across the challenges of today's society: the digital economy, renewable energy, medical imaging, security, environmental science and policy, and nanotechnology.

The Faculty consists of the Departments of Electronic Engineering (EE), Physics, Mathematics, Computing, and the Engineering Divisions of Civil, Chemical and Environmental Engineering (CCE), and of Mechanical, Medical and Aerospace Engineering (MMA).

Our research centres include: Advanced Technology Institute, Centre for Communication Systems Research, Centre for Environmental Strategy, Centre for Nuclear & Radiation Physics, Centre for Vision, Speech & Signal Processing, Surrey Materials Institute and Surrey Space Centre.

The main themes of our research are:

- Advanced Materials, Devices and Nanotechnology
- Aerospace, Fluid Dynamics and Vehicles
- Health and Life Science Interface
- Information and Communication Technologies
- Mathematics and Theoretical Physical Sciences
- Nuclear and Radiation Science
- Sustainability, Energy and Environment



|   | Aerospace, Fluid Dynamics & Vehicles | Advanced Materials, Devices & Nanotechnology | Health & Life Sciences Interface    | Information & Communications Technology | Mathematics & Theoretical Physical Sciences | Nuclear & Radiation Science | Sustainability, Energy & Environment |
|---|--------------------------------------|--|-------------------------------------|---|---|-----------------------------|--------------------------------------|
| Advanced Technology Institute                 |                                      | ● Nanoelectronics                            | ● Bio sensors                       | ● High speed devices                    | ● Condensed matter theory                   |                             | ● Photovoltaics                      |
|   |                                      | ● Photonics                                  | ● Medical applications of ion beams | ● Displays                              |   |                             |                                      |
|   |                                      |  |                                     | ● Optical communications                |   |                             |                                      |
| Centre for Communication Systems Research     |                                      |  | ● Assisted living                   | ● Mobile communications                 |   |                             | ● Green radio                        |
|   |                                      |  | ● Patient monitoring                | ● Networks                              |   |                             | ● Low energy networks                |
|   |                                      |  |                                     | ● Satellite communications              |   |                             |                                      |
| Centre for Environmental Strategy             |                                      | ● Environmental risk                         | ● Pollution                         | ● Smart grids                           |   | ● Energy policy             | ● Energy policy                      |
|   |                                      |  |                                     | ● Energy efficiency                     |   |                             | ● Climate policy                     |
|   |                                      |  |                                     |   |   |                             | ● Consumption                        |
| Centre for Nuclear & Radiation Physics        |                                      |  | ● Medical imaging                   |   | ● Theoretical nuclear physics               | ● Radiation detectors       | ● Environmental protection           |
|   |                                      |  | ● Radiotherapy                      |   |   | ● Nuclear physics           | ● Nuclear energy                     |
| Centre for Vision, Speech & Signal Processing |                                      |  | ● Medical imaging                   | ● Vision and speech processing          |   |                             |                                      |
|   |                                      |  |                                     | ● Multimedia                            |   |                             |                                      |
| Computing                                     |                                      |  | ● Disease identification            | ● Neural networks                       |   |                             |                                      |
|   |                                      |  | ● Ecology                           | ● Security                              |   |                             |                                      |
|   |                                      |  |                                     | ● Digital economy                       |   |                             |                                      |
| Mathematics                                   | ● Astrodynamics                      |  | ● Biological & medical modelling    |   | ● Mathematics                               |                             | ● Environmental flows                |
|   | ● Fluid dynamics                     |  |                                     |   | ● Statistics                                |                             | ● Climate change                     |
|   | ● Meteorology                        |  |                                     |   |   |                             | ● Industrial ecology                 |
| Mechanical, Medical & Aerospace Engineering   | ● Vehicle engineering                | ● Structural materials                       | ● Biomedical engineering            |   | ● Computational fluid dynamics              |                             |                                      |
|   | ● Fluids                             | ● Materials engineering                      |                                     |   |   |                             |                                      |
| Surrey Materials Institute                    |                                      | ● Ceramics                                   | ● Biophysics                        |   | ● Theoretical biophysics                    |                             | ● Infrastructure                     |
|   |                                      | ● Structural damage                          | ● Biomaterials                      |   |   |                             | ● Geotechnics                        |
|   |                                      | ● Soft matter                                |                                     |   |   |                             |                                      |
| Surrey Space Centre                           | ● Spacecraft                         |  | ● Bio-mimetics                      | ● Satellite communications              | ● Astrodynamics                             | ● Radiation effects         | ● Earth observation                  |
|   | ● Mobile robots                      |  | ● Biochemical sensors               | ● On-board computing                    | ● Signal processing                         | ● Radiation mitigation      | ● Power storage                      |
| Water and Chemical Processes                  | ● Fluid flow                         | ● Nanomaterials                              | ● Mathematical biology              |   |   |                             | ● Osmosis                            |
|   |                                      |  |                                     |   |   |                             | ● Water                              |

Department/division key:  
 ● Civil, Chemical & Environmental Engineering

● Computing  
 ● Electronic Engineering  
 ● Mathematics

● Mechanical, Medical & Aerospace Engineering  
 ● Physics

● Where bullets are split into two colours the research is conducted through both departments.

### Engineering and Physical Sciences Research Themes

#### Advanced Materials, Devices and Nanotechnology

The science of materials and their applications underpins much of modern technology. The subject is highly interdisciplinary by its nature.

The Advanced Technology Institute focuses on the functional materials for electronic and photonic devices. Here chemists produce new materials, physicists study the electronic and optical properties and electronic engineers work to apply them in useful devices and circuits. Cross-cutting themes include energy (in particular photovoltaics and LEDs), health care and information technology. The Ion Beam Centre is the UK's national centre for research in ion beams and their applications, for example, in silicon micro- and nano-electronics.

The Surrey Materials Institute concentrates on structural materials and their mechanical, structural and thermodynamic properties. In this Institute, civil and chemical engineers work alongside materials scientists and physicists, on infrastructure and geotechnics, soft matter physics, interface science and engineering, surface phenomena and structural materials functionality.

[www.surrey.ac.uk/feps/research/advancedmaterials](http://www.surrey.ac.uk/feps/research/advancedmaterials)

#### Aerospace, Fluid Dynamics and Vehicles

This theme covers transport through space, air and on the road.

The Surrey Space Centre (SSC) houses multidisciplinary world-class academic engineering research teams that specialise in RF, dynamic control, propulsion, remote sensing, robotics and planetary environments for space systems. SSC underpins developments in Surrey Satellite Technology Limited (SSTL) which is world renowned for designing, building and launching low-cost satellites.

Building on strong links with Formula 1 teams, the Vehicle Engineering Group's research areas are vehicle simulation and trackside analysis, design and manufacturing support and systems engineering support.

In fluids research, the Thermo-Fluid Systems University Technology Centre, supported by Rolls-Royce Plc, focuses on turbomachinery internal fluid and thermal systems, while the Environmental Flow Research Centre (EnFlo) works on laboratory-scale simulation of atmospheric flow and pollutant dispersion.

Outside the main contributors to this theme, the Geometry, Mechanics and Fluids Group in Mathematics conducts research on astrodynamics with SSC and on atmospheric fluid flows with EnFlo.

[www.surrey.ac.uk/feps/research/aerospace](http://www.surrey.ac.uk/feps/research/aerospace)

#### Health and Life Science Interface

This theme gathers together the diverse activities within the engineering and physical sciences with applications in bio-medicine. There is significant research throughout the Faculty in this area and there are many Centres and Departments that contribute to this theme.

The Faculty has significant activity in cancer care and other major health concerns. Medical physicists in the Centre for Nuclear and Radiation Physics work on diagnosis and therapy technologies, and collaborate with electronic engineers from the Centre for Vision, Speech and Signal Processing who are improving imaging modalities.

For the ageing society, the Centre for Communication Systems Research is developing systems for assisted living. Engineers in the Ion Beam Centre within the Advanced Technology Institute conduct translational medical research using a vertical nanobeam in conjunction with mathematical models developed by chemical engineers to study tumour growth, proliferation and patient outcomes.

Within Biomedical Engineering, technology is applied to the development of equipment and measurement methods for use in health care. Research on biomaterials, proteins and cells is carried out by physicists and materials scientists in the Surrey Materials Institute.

There are mathematicians performing biological and medical modelling in the Modelling, Numerics and Applications Group, and computer scientists are working on the development of computational methods for identification of disease in the Biologically Inspired Modelling and Applications Group.

[www.surrey.ac.uk/feps/research/health](http://www.surrey.ac.uk/feps/research/health)

#### Information and Communication Technologies

Information and Communication Technologies research is, naturally, mainly the preserve of electronic engineers and computer scientists.

The Centre for Communication Systems Research within the Department of Electronic Engineering is the largest academic grouping in communications in Europe. Research covers systems for wireless and mobile communications beyond 3G, satellite and fixed networks, higher layer applications areas, new services and sensor networks.

The Centre for Vision, Speech and Signal Processing, also within the Department of Electronic Engineering, engages in research on multimedia signal processing and multimodal sensory data analysis. The focus is on developing high-level machine perception technology and the Centre has strong links to the Institute of Sound Recording (IoSR) in the Faculty of Arts and Human Sciences.

In Computing, research focuses on the software aspects of secure communications in the Formal Methods and Security Group, communications in complex systems in the Digital Ecosystems Group and machine learning/intelligence in Biologically Inspired Modelling and Applications.

Outside of the main contributors to this theme, researchers in the Advanced Technology Institute are developing new electronic and opto-electronic devices and technologies for hardware systems, while researchers in the Ion Beam Centre are using experimental and theoretical studies to push the frontiers of novel device development.

[www.surrey.ac.uk/feps/research/ict](http://www.surrey.ac.uk/feps/research/ict)

### Mathematics and Theoretical Physical Sciences

This theme highlights non-linear mathematics and its applications, theoretical physics, and computational modelling of complex phenomena.

In Mathematics, research is organised around five themes: Analysis of Partial Differential Equations; Ergodic Theory; Geometry, Mechanics and Fluids; Modelling, Numerics and Applications; and Mathematical Statistics. Particular focus is placed on two-way interactions at the interface between pure and applied research, between the development of new mathematics and the modelling and analysis of concrete problems.

Cross-disciplinary research areas that Mathematics contributes to include the dynamics and control of spacecraft (with the Surrey Space Centre), environmental fluid flows (with the Fluids Group and the Centre for Environmental Strategy), biomedical modelling (with Physics), systems biology (with Microbial Sciences), and the modelling and analysis of complex social and economic systems (with Computing, Sociology and the Centre for Environmental Strategy).

Theoretical physics research includes theoretical condensed matter physics (Advanced Technology Institute and Surrey Materials Institute) and theoretical nuclear physics (Nuclear and Radiation Physics).

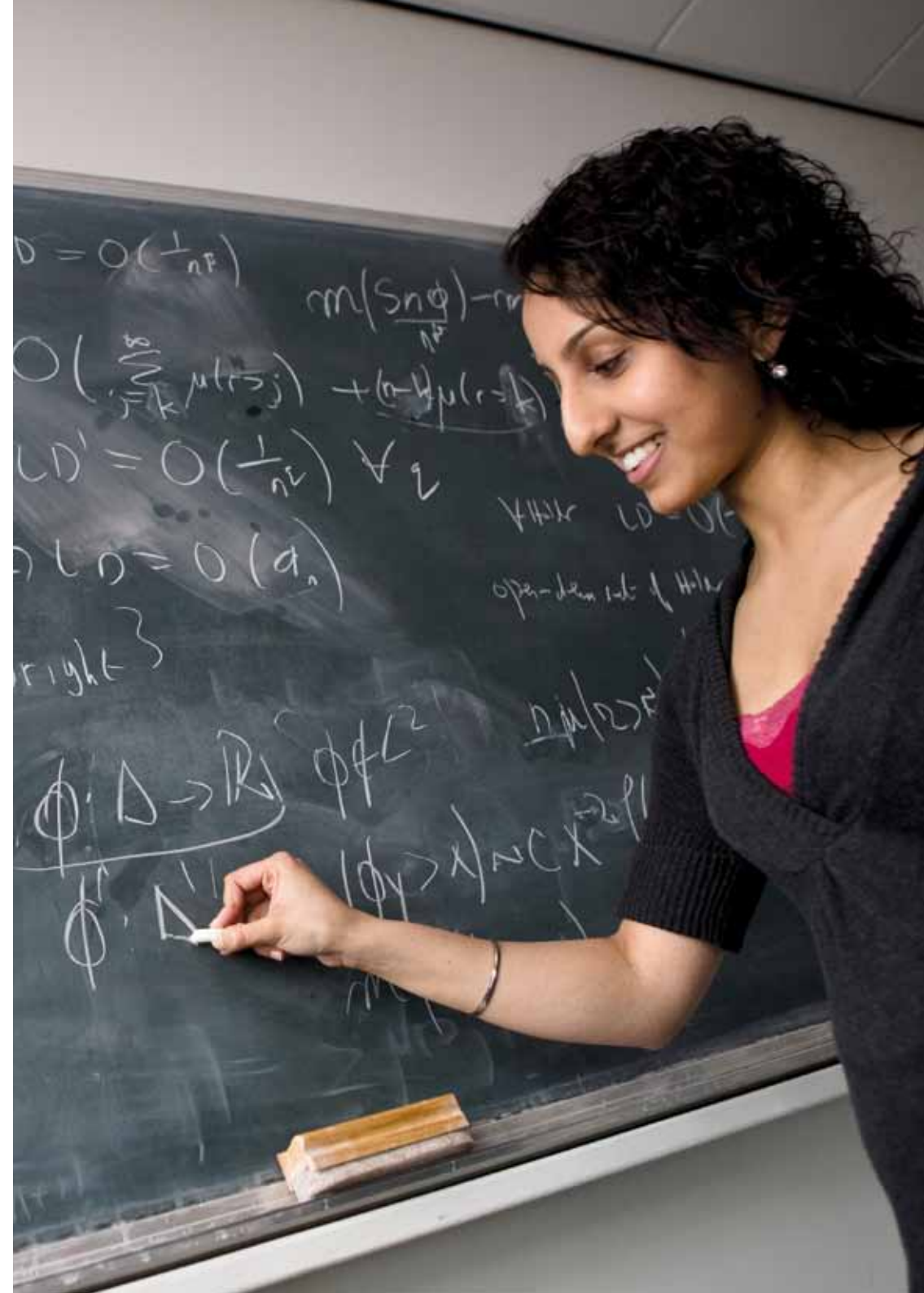
[www.surrey.ac.uk/feps/research/maths](http://www.surrey.ac.uk/feps/research/maths)

### Nuclear and Radiation Science

Fundamental science is central to the ethos of the Faculty, which is home to one of the largest nuclear physics groups in the country. The Centre for Nuclear and Radiation Physics (CNRP) brings together expertise in both pure and applied nuclear physics, covering both experimental and theoretical aspects.

The pure research focuses on studies of exotic nuclei using radioactive beams; experiments are performed at leading European and other international accelerator facilities. The applied research has an emphasis on radiation detector/sensor science and also includes studies of environmental radiation effects and medical physics applications. There is a formal research link with the Royal Surrey County Hospital, and also strong links between the radiation physicists in CNRP and the Ion Beam Centre within the Advanced Technology Institute.

[www.surrey.ac.uk/feps/research/nuclear](http://www.surrey.ac.uk/feps/research/nuclear)



### **Sustainability, Energy and Environment**

This theme encompasses the requirements of the new political and business agenda as well as policy research. There is significant activity throughout the Faculty in the area of technology solutions for generation of resources and their efficient and cleaner use.

The Centre for Environmental Strategy (CES) takes a multidisciplinary approach to the analysis of sustainable systems, with key research priorities including: energy and climate change mitigation and adaptation; sustainable consumption and production; and sustainable infrastructure.

The Surrey Energy Network links energy-related research and teaching from across the University, enabling multidisciplinary activities. Within the Faculty, energy technology development includes photovoltaic work by physicists and electronic engineers in the Advanced Technology Institute, and 'green radio' by communications engineers in the Centre for Communication Systems Research. Modelling and analysis is undertaken of high-efficiency processes for bioenergy and petroleum refineries in Chemical Engineering, and of SmartGrids in CES.

Similarly, the University's Water Network brings together civil engineers from Environmental Health Engineering, chemical engineers from Osmosis Research and sustainability analysis and policy from CES. The Water Network undertakes a broad and dispersed range of 'water-related' activities including water quality and health, sustainable water, wastewater and desalination treatment processes.

The Surrey Space Centre produces satellites that contribute to Earth observation and develop environmental data. The Department of Mathematics collaborates with the Centre for Environmental Strategy (CES) on issues relating to climate change, and with CES, the Department of Computing and the Department of Sociology on the modelling and analysis of industrial ecosystems.

[www.surrey.ac.uk/feps/research/sustainability](http://www.surrey.ac.uk/feps/research/sustainability)



Every effort has been made to ensure the accuracy of the information contained in this brochure at the time of going to press. The University reserves the right, however, to introduce changes to the information given including the addition, withdrawal or restructuring of degree programmes.  
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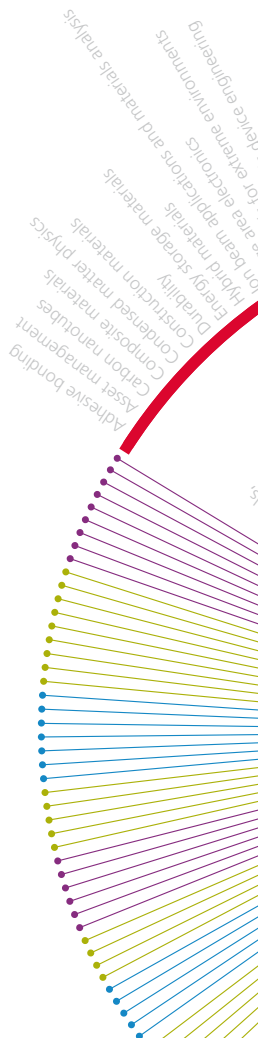
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