

Imperial College
London



The Department of
**Chemical
Engineering**

**The ChemEng
Discovery Space**





Welcome to The ChemEng Discovery Space

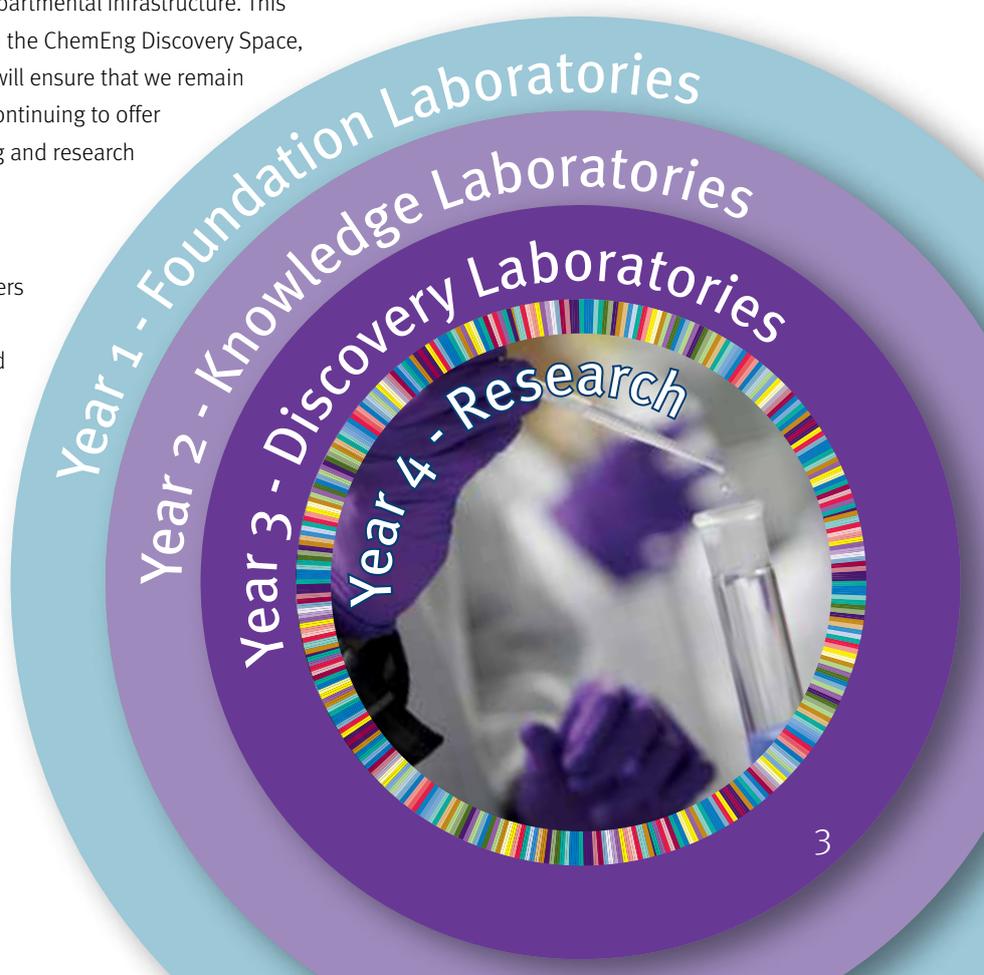
As Head of the Department of Chemical Engineering at Imperial College London, I am pleased to welcome you to our new state-of-the-art teaching and research facilities, including the world's most advanced Carbon Capture Pilot Plant in an educational facility.



Already a world-leading Department in the field of chemical engineering, we recently embarked on a project to revolutionise and reinvigorate our Departmental infrastructure. This £9 million investment in the ChemEng Discovery Space, the largest in 30 years, will ensure that we remain a global powerhouse, continuing to offer the very best in teaching and research opportunities.

Discovery underpins everything we do in the Department, whether we are researchers, teachers or students and we firmly believe that the first class quality of learning outcomes is determined by having a fully hands-on education. I'm immensely proud that our young chemical engineers will continue to graduate with an unrivalled expertise, taking their place in industry and government as leaders of the future.

Professor Andrew Livingston FEng
Head of the Department of Chemical Engineering
Imperial College London



The Carbon Capture Pilot Plant

Tomorrow's technology for today's students

Stretching over four floors, the new Carbon Capture Pilot Plant is at the centre of the Chemical Engineering Department, providing a fully hands-on discovery experience for students and researchers alike.

Built to the highest industrial standards, our plant is a core part of the training we provide to all of our young chemical engineers, typifying many of the features that graduates will encounter in the 'real world', and giving them skills that will be essential in their future careers.

Our futuristic Carbon Capture Pilot Plant is also a vital resource in the fight against climate change, demonstrating best practice in capturing and storing harmful Carbon Dioxide (CO₂) before it can be released into the atmosphere.

We actively encourage leading industrial organisations to use our facility for research purposes, with the hope that one day the technology will be adopted on a much larger scale at power stations across the world, capturing CO₂ emissions before they harm the planet.

Our vision is backed by the UK Government, who are sponsoring a £1 billion competition to encourage companies to develop Carbon Capture technology on a commercial scale between 2016 and 2020.

Pilot Plant Technical Specifications

The Carbon Capture Pilot Plant consists of two primary columns, both 11 metres high and a quarter of a metre in diameter. One is the absorber column, whilst the other is known as the regenerator or stripper column. Both are fitted with visualisation ports, allowing the processes inside to be observed by students and researchers. The absorber column runs at 1.8 barg, and fluids can be recirculated at a rate of 1200kg/hour. The Plant is capable of capturing 1.2 tonnes of CO₂ per day.

The process is fairly straightforward: a mixture of nitrogen and carbon dioxide enters via a pipe at the bottom of the absorber column, before rising and mixing with an aqueous solution of Monoethanol Amine (MEA) coming down from the top of the column. The CO₂ and the MEA react with each other and form a chemical complex in-solution, with the harmful CO₂ now captured within the MEA solution.

The CO₂ rich MEA solution is then pumped to the top of the regenerator/stripper column and heated to a temperature close to 125°C via a steam reboiler, resulting in the CO₂ being separated from the MEA solution and exiting via a pipe for storage or use. The now "lean" MEA solution is then pumped back to the top of the initial absorber column so that the process can be repeated.







ABB Pilot Plant Control Room



The beating heart of the Department

The show-stopping ABB Control Room is the nerve centre of the Carbon Capture Pilot Plant, giving students the opportunity to gain hands-on knowledge that will be crucial in their future careers.

Created as part of a new ten year strategic alliance with ABB, a world-leader in instrumentation and automation systems, the state-of-the-art facility gives undergraduates the chance to control our industrial-standard Pilot Plant, learning key skills such as how to start up the facility, shut it down as well as operate it safely and efficiently. As a result of this training, our students graduate from university with an unrivalled expertise, making them more employable in an increasingly competitive sector.

Advanced technology plays an important role in the ABB Control Room, and over two hundred ABB industrial instruments are

installed in the Pilot Plant so that students can measure process critical variables such as pressure, temperature, flow rate, pH, liquid level, pump speed and motor speeds.

Several web cams are installed around the facility, with the feeds from these displayed on screens in the ABB Control Room alongside the main graphical process interface. Students are encouraged to use Apple iPads® in the Pilot Plant, and with each device linked to the central console screens, they can refer to the Plant's schematics at the touch of a screen, as well as remotely control or monitor its operation in real time.



World-class laboratories

First-class facilities at a world-class university

We have completely revamped all of our teaching laboratories, increasing efficiency by combining them into The ChemEng Discovery Space and significantly improving access for people with disabilities.

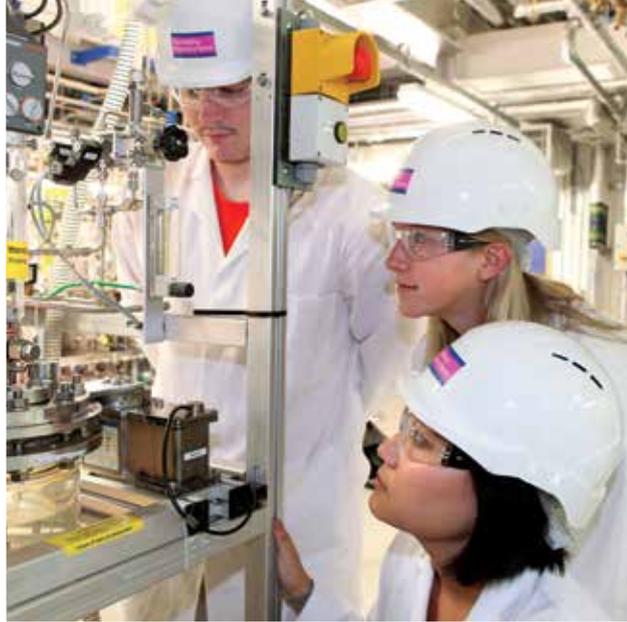
In addition, we have created an entire new floor of laboratories, delivering more than 3000 sq ft of new Departmental space in the process. A new analytical laboratory and suite of staff offices have been created here, allowing for further teaching and research opportunities.

Our undergraduate laboratories have seen a radical overhaul, with each now comfortably holding up to 50 students. Safety has been vastly improved, with better ventilation and the installation of auto-closing sash fume cupboards. Many of these are low velocity units, providing excellent energy efficiency.

As part of the refurbishment we have entirely re-designed our laboratory based undergraduate teaching curriculum. This work has been supervised by our new team of Teaching Fellows, who are our lead learners, reflecting our long term investment in both people and facilities for teaching.

This project has enabled the creation of a number of new high specification research laboratories designed to underpin and advance our world-class research activities in energy research.





Summer School



The Chemical Engineering Department has designed a series of exciting hands-on educational sessions that allow students to expand their knowledge outside traditional term time.

Our new Summer School scheme offers international chemical engineering undergraduates the chance to enroll on an academically challenging and culturally stimulating programme of sessions over four to six weeks in the centre of London.

As well as being given hands-on instruction on how to operate our new Carbon Capture Pilot Plant, students will take part in a bespoke range of undergraduate laboratory experiments based on our current M.Eng. curriculum, and will also have an opportunity to take guided visits around a number of cultural and historical sites in and outside London.

The Summer School is ideal for chemical engineering students currently between the second and third years of their undergraduate course, and will allow them to broaden academic and cultural knowledge that will be necessary in their future careers.

We invite representatives from chemical engineering departments to contact us for more information about our Summer School programme, the course structure and how we may adapt it for your own students, or create a new one. Details are on our website at:

<http://www3.imperial.ac.uk/chemicalengineering/discovery/summerschool> or email us at chemengdiscovery@imperial.ac.uk



Process Control and Instrumentation courses

Commencing in 2014 academic year, the Department will be starting a new exciting course: a Masters of Science in Process Control and Instrumentation. This course is designed to be the world-leading course for preparing students for industrial careers in the sectors of process measurement, automation-control and industrial and scientific instrumentation. The new Discovery Space facilities including the Pilot Plant, ABB Control Room and undergraduate laboratory will also be key elements of this new course.

We have specifically designed this course to appeal to students who are either working industrially and wish to further develop their careers, or are new engineering or science graduates who wish to undertake an intensive programme of advanced study and training to prepare themselves for careers in process control and instrumentation. We also welcome mature students within industry who may wish to include this course within their life-long learning plans for career development.

This new course has a very flexible structure which will allow students to study as part-time or full time MSc., a Diploma level course, a Masters of Research or to simply enrol on any module of interest as a continuing professional development (CPD) candidate.

A key ethos of the course will be its industrial relevance and the course modules have been developed in conjunction with a number of world leading industrial companies in the process control and instrumentation sector. Indeed many of the course modules will be taught by industrialists whose knowledge

and practical experience provide a real-world dimension to the academic rigour which is a hallmark of the courses taught at Imperial College and have placed us among the top ten departments globally. We expect graduates from this course to be in high demand by industry for posts throughout the world.

All modules will be delivered in a short-course format, each module occurring intensively over two weeks: the first week is teaching at the Imperial College campus in South Kensington, including a range of lectures, tutorials, laboratory classes, design workshops and group study exercises. During the following week, all students will finish the module offsite by completing the necessary assignments, design exercises problem sheets, project work, essays or online examinations forming part of the module assessment process.

To encourage the best students from throughout the world to enroll in this course, the Department will be offering a wide range of industrially sponsored scholarships. Please contact us for further details on our scholarship opportunities.



There is a wide range of course options for students, but in the most common MSc. study route the students will select five core modules from the choice of seven offered, as well as a minimum of five elective modules. Following the completion of the ten MSc modules, the students will then complete an agreed research project, with the work being undertaken with an industrial partner, usually on their site. This provides valuable industrial experience for all students. Our courses are continuously developed with, and to the needs of modern industry, and are therefore subject to change; current proposed modules are:

Control Principles

- Electronics, Instrumentation and Signal Processing (for non-electrical engineers only)
- Chemical Processes and Unit Operations (for non-chemical engineers only)
- Data and Device Communications/Protocols
- Project Planning and Management-Processes, Products and Software
- Control and Instrumentation Laboratory (compulsory)

Elective Modules

- Pilot Plant Laboratory
- Advanced Process Control
- Programming 61131
- Programming C# .NET
- Labview Programming
- Energy Efficiency and Energy Auditing
- Safety Systems- 61508/61511
- HMI and Alarm Management
- Advanced Scientific Instrumentation
- Advanced Process Instrumentation
- Embedded Processors and Systems
- Life Cycle Analysis and Management
- Batch Automation
- Business and Finance Principles for Control and Instrumentation



‘...The ChemEng Discovery Space, a fantastic set of facilities that allow students to benefit from a real world educational experience.’

Dr Daryl Williams
Director of Discovery Space

Discover more at:
imperial.ac.uk/chemicalengineering/discovery



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