About Imperial College London

Consistently rated amongst the world’s best universities, Imperial College London is a science-based institution with a reputation for excellence in teaching and research.

The World University Rankings 2012-13

Engineering and Information Technology: 3rd in Europe / 10th in World
Life Sciences: 3rd in Europe / 9th in the World
Physical Sciences: 4th in Europe / 17th in World
Overall: 3rd in Europe / 8th in World

Innovation research at the College explores the interface between science, medicines, engineering and management and delivers practical solutions that improve quality of life and the environment - underpinned by a dynamic enterprise culture.

With 62 Fellows of the Royal Society among our current academic staff and distinguished past members of the College including 14 Nobel Laureates and two Field Medallists, Imperial’s contribution to society has been immense. Inventions and innovations include the discovery of penicillin, the development of holography and the foundations of fibre optics.

This commitment to the application of our research for the benefit of all continues today with current focuses including interdisciplinary collaborations to tackle climate change and mathematical modeling to predict and control the spread of infectious diseases.
STEM World 2014 International Summer School – for High Achieving Students based at Imperial College London

STEM World is a summer school programme designed and delivered by Exscitec in collaboration with Imperial College London Outreach.

Imperial College London Outreach

Imperial College London has a long established reputation for delivering excellent outreach activities to school and college students, and believe in raising the aspirations of all students, regardless of background, to fulfil their potential and apply to the right university for them. Their commitment is to inspire students in the study of science, technology, engineering and medicine.

http://www3.imperial.ac.uk/outreach

Exscitec

Exscitec was founded in 2000 with the aim of providing outreach STEM activities for widening participation and Gifted & Talented students. They provide experiences for educators and young people to raise aspirations, improve attainment in STEM subjects and increase participation in STEM related careers.

https://www.exscitec.com

STEM World Summer School

On offer is a wide selection of educational and stimulating science strands enabling students to engage in hands-on enrichment activities in the science subject of their choice. Strands include day trips, lectures, workshops and discussion seminars designed to encourage high level thinking and stretch the brightest of students.

Based on the historic South Kensington campus of Imperial College London, students will benefit from expert subject tuition and experience life at one of the UK’s most prestigious universities located next to London’s iconic Natural History, Science and Victoria and Albert museums.

For residential students, full board accommodation facilities are available in Imperial College halls of residence adjacent to the main campus. There is a guided social programme of evening and weekend events to enable participants to learn and socialise within this impressive central London location.
Course Aims

• To provide hands on practical STEM investigation in a world class university environment
• To challenge and stretch students and expand their knowledge of their chosen subject area
• To give students from across the world to experience of life at a top UK university
• To give students the chance to mix with peers from across the world
• To expose students to leading academics and current research
• To provide information, advice and guidance on routes into STEM careers
• To provide information and inspire debate on how the STEM subjects influence the world around us
# Courses at a Glance

## July

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I learnt a lot about the subjects that I plan on taking in university and the things I studied in the summer school will most likely inspire me to study harder in the next year.

Wong Gabriel Chun Hei
F.3 (July 2013)

I learnt lots of practical skills, and had lots of fun in the lab. Doing the medical science course, we went to St. Mary’s Hospital, and had a lesson on Robotic & Keyhole Surgery. We even had the chance to undergo some of the training given to surgeons! This morning we did protein crystallization in a lab. A research scientist came to teach us about stem cells, regenerative medicine and its use in pharmacology.

Wong Gabriel Chun Hei
F.3 (July 2013)

I learnt about Platonic Solids, Zero to Infinity, Game Theory, Acids and Bases, Rocket Theory and Polymers…, which I have not been able to learn in Hong Kong at this stage. There are some brilliant classmates who are willing to learn and to share with others. As there are students from all over the world in the class, I had many chances to speak in English and this helped me to improve my oral English. The professors led the class in an interesting way.

Lam Wai Tin, Year 7
(August 2011)
2 Weeks’ Programme
7-18 July 2014 / 4-15 August 2014

**Week One**

Day 1 (Mon)  | Strand introductions, team building activity and start academic sessions.

Day 2 (Tue)  | Academic sessions.

Day 3 (Wed)  | Academic sessions.

Day 4 (Thu)  | Academic sessions.

Day 5 (Fri)  | Complete academic sessions. Students present work at a conference attended by invited guests, academics and family and friends.

Day 6 (Sat)  | Group activities / sight seeing.

Day 7 (Sun)  | Group activities / sight seeing.

**Week Two**

Day 8 (Mon)  | Academic sessions.

Day 9 (Tue)  | Academic sessions.

Day 10 (Wed) | Academic sessions.

Day 11 (Thu) | Academic sessions.

Day 12 (Fri) | Complete academic sessions. Students present work at a conference attended by invited guests, academics and family and friends. Depart for Hong Kong in late evening.

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**Pastoral Programme**

For residential students full board accommodation facilities are available in Imperial College London halls of residence, adjacent to the South Kensington campus.

A full guided social programme of evening and weekend events is offered, to enable students to learn, socialise and take advantage of the world-class museums, theatres, attractions and restaurants within this impressive central London location.
Kick Start to Chemistry [Course Code: 111-KCHEM]  
(for Primary 6, Form 1 & 2 students)

This course introduces students to the chemistry associated with substances we come across in everyday life.

We will investigate the essential role of polymers occurring naturally such as DNA or produced synthetically like polystyrene, students will investigate how polymers are used in the manufacture of bouncing balls and gummy worms.

Through hands-on practical experimentation, students will discover the effect of liquid nitrogen on a range of substances and use particle theory to explain observations. By producing their own indicators using items found around the home, students will investigate the properties of everyday colourful corrosives.

Finally, students will become trainee forensic scientists and attempt to solve a crime by using techniques such as blood detection and fingerprinting.

This course is perfect for would-be chemists looking to discover the building blocks of chemistry present in the world around us.

Engineering [Course Code: 112-ENG]  
(for Primary 6, Form 1 & 2 students)

This course is packed with hands-on design, build, test and competition.

Students will work with undergraduate and graduate engineers on activities that will highlight principles from the main engineering disciplines of mechanical, electrical, aeronautical, chemical and civil engineering.

An introduction to engineering will theme the week and challenges will be set through mini projects as teams explore the practical principles which underpin the practical application of maths and science.

By the end of the week, students will have a really good understanding of engineering disciplines, the engineering design process and how engineers approach and problem solve projects.

If you want to have fun at the same time as learning all things engineering this course is definitely for you!
Business Skills: Science Sells [Course Code: 121-BUSI]  
(for Form 3 & 4 students)

Creating business impact from invention to market.

In this strand, students will acquire practical business knowledge of how products are researched, developed and marketed.

Through exploration of cutting edge research in the fields of Technology, Engineering and Medicine, students will design a product and develop business strategies to lead the invention to market.

By focusing on the 4P’s – Produce, Price, Place and Promotion, students will develop a range of skills and competencies including: design and innovation, formulation of business plans, creation of a brand and communications strategy. They will present a business case and acquire investment by negotiating with the “Dragons Den”.

If the challenges of the business world are your future, this strand is for you.

Advanced Biology [Course Code: 131-ABIO]  
(for Form 4 & 5 students)

Is there life elsewhere in the solar system?  
Could we clone velociraptors?  
Might we ever live forever?

This summer school will explore such questions and examine how recent advances in the biological sciences, from genetic engineering, cloning and stem cell research to biodiversity and astrobiology, are shaping our lives and the world of tomorrow.

Expect to come face-to-face with wild animals, grow your own glow-in-the-dark bacteria and taste-test weird future foods as we dive into the deep end of the life sciences.
Maths Beyond School [Course Code: 132-MATH]
(for Form 4 and 5 students)

A guide to studying numerate subjects at university.

Thinking of studying a numerate subject like maths, physics or engineering at university? Then you’re probably aware that the way these subjects are taught at University is likely to be quite different from what you’ve experienced so far.

This week will expose you to some fascinating and advanced mathematical techniques in a way you might hope to find at university. We will work in areas that are rarely mentioned at school and try to understand some applications of this new maths to real-world situations.

We will step back to see mathematics in a broader light by returning to its foundations, and in doing so help you to understand why rigour and proofs are so important. By examining areas such as topology which are normally only covered at university, we will uncover some exciting application to physics and engineering.

We will kickstart your application process with a look at the specific challenges you might expect to encounter on your journey to university, and develop the broader skills that will help you secure a place. We will help you to understand the admissions process as well as provide tailored interview skills support, confidence and team-working practice, all in a fun environment designed to help you help each other.
Are you interested in medicine, but not necessarily being a medical doctor? Then Biomedical Sciences is the summer school for you!

Biomedical Sciences looks at medicine through the eyes of a scientist and can lead to a wide range of jobs in scientific research or the healthcare sector, as well as being a precursor for medical school.

The beauty of Biomedical Science is that it introduces students to a wide range of subjects related to biology, chemistry and medicine, broadening their knowledge and skills in a variety of areas.

This summer school will provide an insight into a range of subjects including immunology, pathology, molecular biology and microbiology, and will include interactive learning sessions and hands-on practical activities.

In addition, students will have the opportunity to interact with research scientists and learn about current research.
Budding Biologists [Course Code: 211-BBIO]
(for Primary 6, Form 1 & 2 students)

Sew the seeds of scientific enquiry as we explore the kingdoms of life, from bacteria to blue whales, before delving in deeper to see how these complex machines that we call living things work.

This summer school includes lab-based microbiology and dissections, handling wild animals and exploring the great outdoors.

Learn how to hypnotise a shark, discover how chameleons change colour and find out what exploding jellybabies, regenerative axolotls and lungs have in common.

Robotics [Course Code: 212-ROBO]
(for Primary 6, Form 1 & 2 students)

Working alongside undergraduate engineers, students will explore this multi-disciplinary subject through a number of hands-on activities delivered at undergraduate level.

The week will start with an introduction to robotics, followed by a number of sessions that will underpin the design and build process, control and actuation, robotic gripper design, the iterative process and final testing and presentation skills. There will be a continuing thread of team work and problem solving with a hint of lateral thinking throughout the course.

We will help students understand the options available to them whilst studying at university, what their future prospects might be, some challenges that engineers face in the future and understand the multi-disciplinary groups that modern engineers work within. We will help students strengthen personal skills, presentation, communication, confidence and self learning, all key engineer attributes!
**Colour Chemistry**  [Course Code: 221-COLC]
(for Form 3 & 4 students)

This course provides a fascinating insight into chemistry and colour.

Students will investigate how and why chemists use colour to explore and research the world around us. Using experimental skills, students will discover how fireworks get their colour and produce homemade glow sticks, paint and sparklers.

Chemists will attempt to determine the pH of a substance by creating their own indicators using common everyday items and investigate how a glow stick functions by considering particle theory. Using theoretical knowledge, hypothesis and practical investigations, students will discuss their observations and conclude their findings to peers.

If you want to ignite the sparks of colour in your chemical investigations and explore the links between chemistry and every day colourful items, then this course is perfect for you!

**Higher Chemistry**  [Course Code: 231-HCHEM]
(for Form 4 & 5 students)

Have you ever wondered what research chemistry involves?
Well this is the summer school for you!

Working as a team, you will be assigned a project to ‘research’, by using your knowledge of chemistry and some newly acquired laboratory skills.

You will research and investigate:
- How can a reaction be made to oscillate? How can this oscillating pattern be altered?
- When two chemicals react producing heat the reaction is known as exothermic. How might a reaction take place which produces light instead? How might the lifetime of the light-emitting product be extended?
- How can we as chemists, reduce the increasing levels of CO2 in the atmosphere through the use of carbon capture and storage techniques?

This hands-on practical week is ideal for those who are eager to understand what the study of chemistry at university really involves or for those who want to practise undergraduate style extended chemistry projects.
Which Engineering? [Course Code: 232-WENG]
(for Form 4 & 5 students)

Designed to highlight the different types of engineering that are available to study at university, the Which Engineering strand will expose you to all popular disciplines of engineering and engineering professions.

Working alongside undergraduate engineers, team building followed by project work will form the main part of activity.

Breakout sessions are organised to give you the opportunity to talk to admissions tutors, take tours of departments and participate in research led activity of various disciplines, helping cement your future choices.

The course will help you understand the options available whilst studying at University, what your future prospects might be, some challenges that engineers will face in the future and also the multidisciplinary groups that modern engineers work in to problem solve.

We will help you strengthen your personal skills, presentation skills, communication, confidence and self learning - all key engineer attributes!
Physics [Course Code: 233-PHY] (for Form 4 & 5 students)

Physics can teach us about the world in which we live, from the largest galaxies to the smallest subatomic particles. This course will look at topics including astrophysics, electronics, particle physics, optics, relativity and quantum mechanics.

Students will learn the basics of rocketry, construct and launch a pneumatic rocket, calculate how to escape from the gravitational pull of the Earth, build laser transmitters and receivers and explore the magnetic field.

In the cryogenics lab, we will construct particle detectors that enable us to visualise particles and learn how relativity affects measurements. Students will make a model of a comet, learn their composition and how they burn up as they approach the Sun.

Later in the week, students will build spectroscopes to analyse the light emitted from various elements and learn how this is used to study the Universe. With global warming changing the climate it’s more important than ever to find sustainable ways of using energy in developing countries. We will build a solar cooker and attempt to cook with it! Finally, we will visit the Science Museum to watch ‘Hubble 3D’. 
The trip was very intense, challenging, rewarding, beneficial and different. I learnt more than I ever imagined possible. In Hong Kong, I don’t think I could ever have reached the level of independence I had to in London. All the lecturers and mentors I interacted with were all very nice, caring and helpful. I don’t think I could forget anything about it even if I tried.

Yeung Ming Yi Priscilla
P.6 (August 2007)

Participating in the Imperial College Summer School program really nurtured my interest in Maths and research. I lot of Mathematics competitions I won later on was attributed to the Summer Program which did help me a lot, especially the thinking skills. Joining the summer program is definitely one of the important milestones in my life because it not only deepened my interests in Maths but also broadened my global horizons.

Kung Wai Kwun
F.3 (August 2006)

We also have chance to use the university facilities as every other undergraduates do. That made this summer school experience really unique and valuable. Pastorally, this year’s night activities were also quite fun, and absolutely good to get you relax from the academic life.

Ying Xiang
F.2 (August 2011)

It was a very extraordinary trip. Besides learning loads of things, I also met students from other countries. They were more initiative in learning. I think I should learn from them. In these two weeks, my most memorable event was doing presentation twice in English for the first time in front of other students, teachers and parents.

Yan Tsz Hin Benedict
F.6 (August 2010)
CSI London [Course Code: 311-CSI]
(for Primary 6, Form 1 & 2 students)

Become a STEM detective by solving a hypothetical crime.

This course is aimed at students who envisage themselves as budding forensic scientists, wanting to put all their scientific and mathematical skills to use in a fun, hands-on and practical way through the thorough investigation of a real-life scenario.

Using skills and techniques from various disciplines, students will break codes, produce invisible ink, create smoke screens and identify the perpetrator through blood detection and typing, fingerprinting and DNA extraction.

At the end of the experience, future scientists will be able to scientifically communicate their findings based on the strength and validity of the evidence.

Mathemagic [Course Code: 312-MMAG]
(for Primary 6, Form 1 & 2 students)

This challenging week will build on areas of maths that you may already have studied at school and will enable you to see in a new light. You will discover a range of real-world situations that maths can help us understand as well as appreciate the magic of maths in its own right.

We will ask why the triangular chicken crossed a very special type of road in order to figure out how many dimensions there might be, as well as answering questions like “how far can a rocket fly?” and “why is the shape of a football interesting?” through a range of exciting hands-on activities.

By using maths to analyse problems in engineering, as well as a business-like negotiation, we will broaden your perspective of the subject and convince you that maths really is magic!

(Disclaimer: there will be no magic wands involved in the academic component of this week, but there will be plenty of fun, lively discussions and of course logical deductions)
Mission to Mars [Course Code: 321-MMARS]
(for Form 3 & 4 students)

Earth… A planet we know… A planet we’ve explored… But now you have been chosen to go to Mars! How will you get there and what will you use to explore this new planet?

Before setting out on their mission, students will learn what it takes to be an astronaut and study the universe in detail.

How will you get there? By rockets of course!

Students will build their own rockets and robotic support team to help them explore this new land.

Finally students will investigate life on mars… is it possible?

This course is ideally suited to students who wish to explore all areas of science within the parameters of a week long mission.

Intermediate Maths [Course Code:322-INTMA]
(for Form 3 & 4 students)

Just how far can you count? This sounds like a question that has already been answered, but has it?

We will use explorations like this to discover the fascinating mathematical world of number theory, as well as putting these ideas in context to discover some surprising real-life applications.

We will attempt to break codes in order to understand cryptography from its very beginnings right up to the present day, and see how maths can help those in the business world far beyond the accountant’s office.

By stretching our horizons far beyond A-Level in an accessible format using fun and hands-on explanations, we will aim to discover exactly why maths really is such a fundamental subject and convince ourselves that it’s something worth studying.

As part of a series of dynamic team-based challenges, we will even try our hands at some mathematically themed origami to see who folds fastest under pressure.
Advanced Engineering [Course Code: 331-AENG]
(for Form 4 & 5 students)

Working alongside undergraduate engineers, students will explore this multidisciplinary subject through a number of hands-on design, build and test activities. Delivered at undergraduate level these activities will highlight principles linked to the classic engineering disciplines of mechanical, electrical, aeronautical, chemical, civil, materials and biomedical.

There will be a continuing thread of team work and problem solving with a hint of lateral thinking throughout the course!

We will help students understand the options available to them whilst studying at university, what their future prospects might be, understand the multidisciplinary groups that modern engineers work in and the challenges that engineers may face in the future.

We will help students strengthen their personal skills, presentation skills, communication, confidence and self learning - all key engineer attributes!

Biochemistry: Food for Thought [Course Code: 332-FOOD]
(for Form 4 & 5 students)

With an emphasis on current affairs and how science can help us overcome global issues, this multidisciplinary summer school will benefit students with a wide-range of interests, and will incorporate many fields from the biological and chemical sciences, alongside engineering and medicine.

Questions to investigate will include:
Why does chocolate make us feel good?
What makes a chilli so hot?
How are we going to feed tomorrow’s world?

Join us as we tuck into the science behind the culinary arts, aiming to investigate the advanced biochemistry that happens at every mealtime and tackle the challenges we face in order to feed an ever-rising global population.

Design engineering solutions to help solve hunger in poorer communities, experience the neuroscience behind sensory perception, discover microbiology and genetically modify organisms in the lab.

How will science and technology shape the future of our food sources?
Bon appétit!
Robotics [Course Code: 411-ROBO]
(for Primary 6, Form 1 & 2 students)

Working alongside undergraduate engineers, students will explore this multi-disciplinary subject through a number of hands-on activities delivered at undergraduate level. The week will start with an introduction to robotics, followed by a number of sessions that will underpin the design and build process, control and actuation, robotic gripper design, the iterative process and final testing and presentation skills.

There will be a continuing thread of teamwork and problem solving with a hint of lateral thinking throughout the course!

We will help students understand the options available to them whilst studying at university, what their future prospects might be, some challenges that engineers face in the future and understand the multi-disciplinary groups that modern engineers work with.

We will also help students strengthen personal skills, presentation skills, communication, confidence and self learning - all key engineer attributes!

Kick Start to Chemistry [Course Code: 412-KCHEM]
(for Primary 6, Form 1 & 2 students)

This course introduces students to the chemistry associated with substances we come across in everyday life.

We will investigate the essential role of polymers. Occurring naturally as DNA or produced synthetically like polystyrene, students will investigate how polymers are used in the manufacture of bouncing balls and gummy worms.

Through hands-on practical experimentation, students will discover the effect of liquid nitrogen on a range of substances and use particle theory to explain observations. By producing their own indicators using items found around the home, students will investigate the properties of everyday colourful corrosives.

Students will become trainee forensic scientists and attempt to solve a crime by using techniques such as blood detection and fingerprinting.

This course is perfect for would-be chemists looking to discover the building blocks chemistry presents in the world around us.
Astrophysics [Course Code: 421-ASTRO]
(for Form 3 & 4 students)

Astrophysics covers some of the most fundamental questions in the Universe. What is our place in the cosmos? How did we get here and how will it all end? Are we alone in the Universe and would we want to find out?! Using an in-situ telescope, students will make observations from a fantastic dark-sky site and will be able to continue to use the telescope from home once the course ends.

We will visit the Natural History Museum to look at their excellent meteorite collection, collect our own micrometeorites on campus and analyse them under the microscope. We will perform a number of experiments to see how the sizes of the craters on the Moon can help determine the size of the rock that caused them.

In the optics lab, we will build spectroscopes to analyse the light emitted from various elements and learn how astronomers use this to study everything from stars to the evolution of the whole Universe. We will also construct a basic telescope to see how Galileo first discovered the moons of Jupiter.

We will build detectors to enable us to view invisible particles streaming through our bodies and learn how Einstein’s Theory of Relativity affects results. We will discuss Dark Matter and the even more mysterious Dark Energy which together make up over 95% of the Universe.

Later on, we will visit the Royal Observatory at Greenwich to find out how Britain became a world leader in astronomy, and stand on the Greenwich meridian line with one foot in each of the eastern and western hemispheres of the Earth!
Advanced Mathematics [Course Code: 431-MATH]
(for Form 4 & 5 students)

Mathletics - from the Olympics to Amazon.co.uk

You might be aware that μ is a lot more than just a noise that cats make, but why are the ancient Greeks so intertwined with modern mathematics?

By following the winding path along which mathematics has developed, we will aim to uncover some unexpected connections between different areas and try to explain what makes maths so special among the sciences.

We will look far beyond what is normally covered before university to develop geometry into topology, number theory into cryptography and mechanics into rocketry from the very foundations of the subject.

As well as examining some aesthetically beautiful representations of mathematical concepts we will see how mathematics can be applied to help us understand the natural as well as the synthetic world.

From weather forecasting to financial markets, mergers and acquisitions to marketing, we will complete our journey with a look at the very cutting edge of mathematics and its applications to modern life.

Medical Sciences [Course Code: 432-MEDSC]
(for Form 4 & 5 students)

This summer school will introduce students to a range of medical disciplines, and will include fields such as pulmonology and reproductive biology.

Sessions will be led by clinicians affiliated to Imperial College London, and will consist of hands-on interactive sessions as well as lecture and discussion-based learning at various London medical institutes.

In addition, students will partake in sessions to improve problem based learning skills, a key requirement for the medical field. Students will learn more about the process of applying to medical school, and have the opportunity to interact with Imperial College medical students where they can discuss the interview process and life as a medical student.
Zoology (Course Code: 433-ZOO) (for Form 4 & 5 students)

Take a walk on the wild side and embark on an expedition to explore the animal kingdom!

Delve into everything from cell biology under the microscope to exotic anatomical dissections in the lab, before stepping out into the great outdoors.

Come face-to-face with wild animals, including primates great and small whilst undertaking behavioural work at ZSL London Zoo, as we investigate biodiversity, conservation and the evolutionary tree of life.
Admission Criteria & Fees

**Accommodation**

Students are housed in University Halls of Imperial College. Bed linen and towels are provided. All meals, or the cash/vouchers for meal purchases are provided.

**Supervision**

The University has 24 hour security surveillance and first aid support. Students will be supervised on a ratio of 1:10 by female and male staff and the mentors and supervisors will be resident in the same accommodation area each night. Students will be assigned an undergraduate Academic Mentor who will guide them through the various activities on the course and a Pastoral Mentor who will be with their group in the evening and at morning registration and breakfast.

**Admission Criteria**

- 12 - 17 years old on 1 July 2014
- Highly motivated in studying science
- Double distinctions in Mathematics and Problem Solving in the same World Class Tests, or top 10% in the school (with school recommendation)
- Good proficiency in English.

**Course Fee**

Application Fee: HKD 300  
2 weeks’ Program Fees: HKD 28,950  
(this includes: 2 weeks residential, middle weekend stay, local transport, course fee, accommodation, food and activities, but does not include air-tickets and insurance)

**Application Deadline**

15 March, 2014

Application offers will be made on a rolling basis. Early application is recommended as courses may be filled up by qualified applicants prior to the deadline. Late applicants may be put on a waiting list and be considered if vacancy is available.

Application Form: [http://www.worldclassarena.hk/ic](http://www.worldclassarena.hk/ic)
Enquiries

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Fax + 852 2348 8687
E-mail ic2014@worldclassarena.hk

This brochure contains information as of January 2014. Imperial College London reserves the right to modify any information without prior notice. Please refer to www.worldclassarena.hk website for the lastest information.