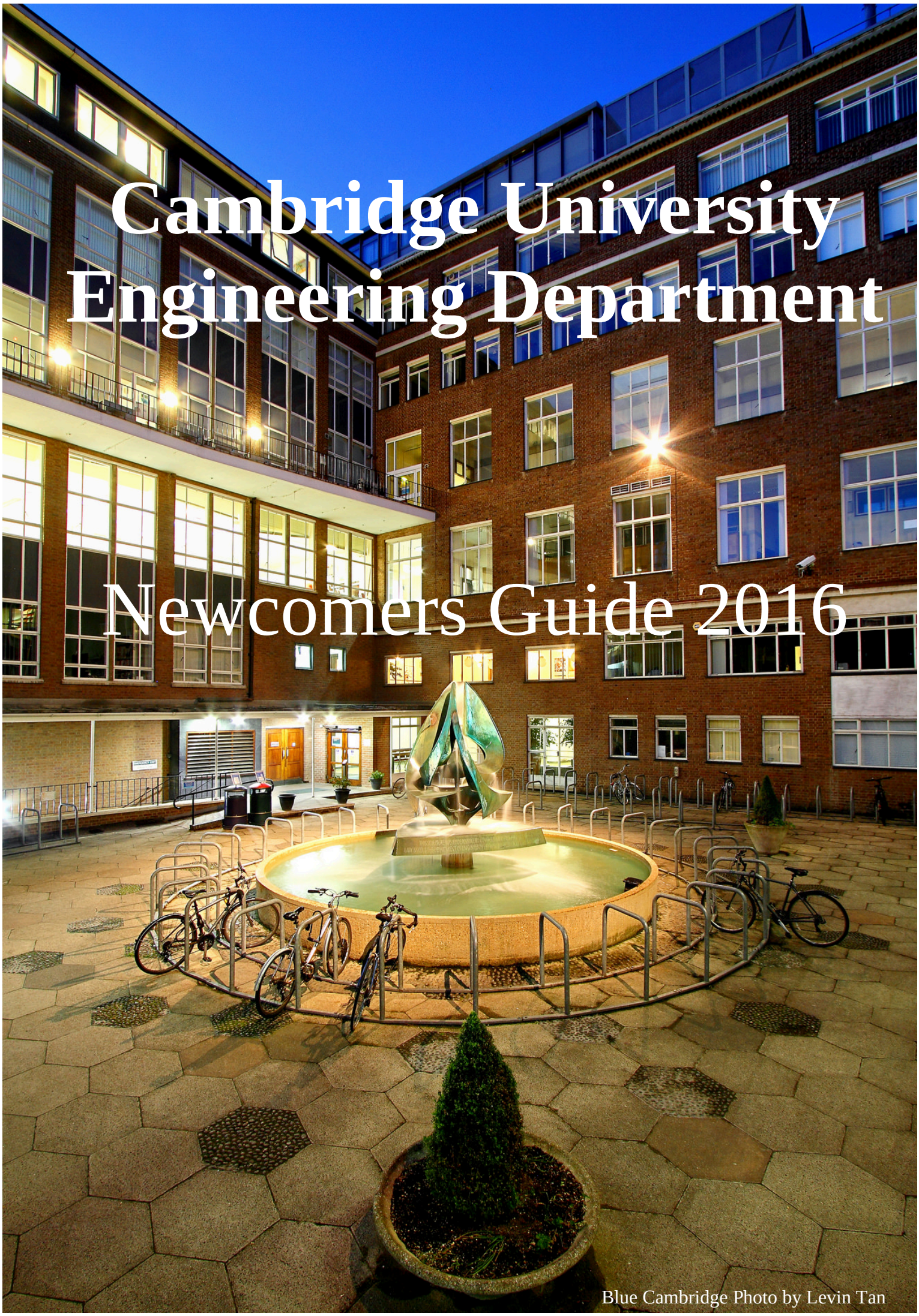
Cambridge University Engineering Department

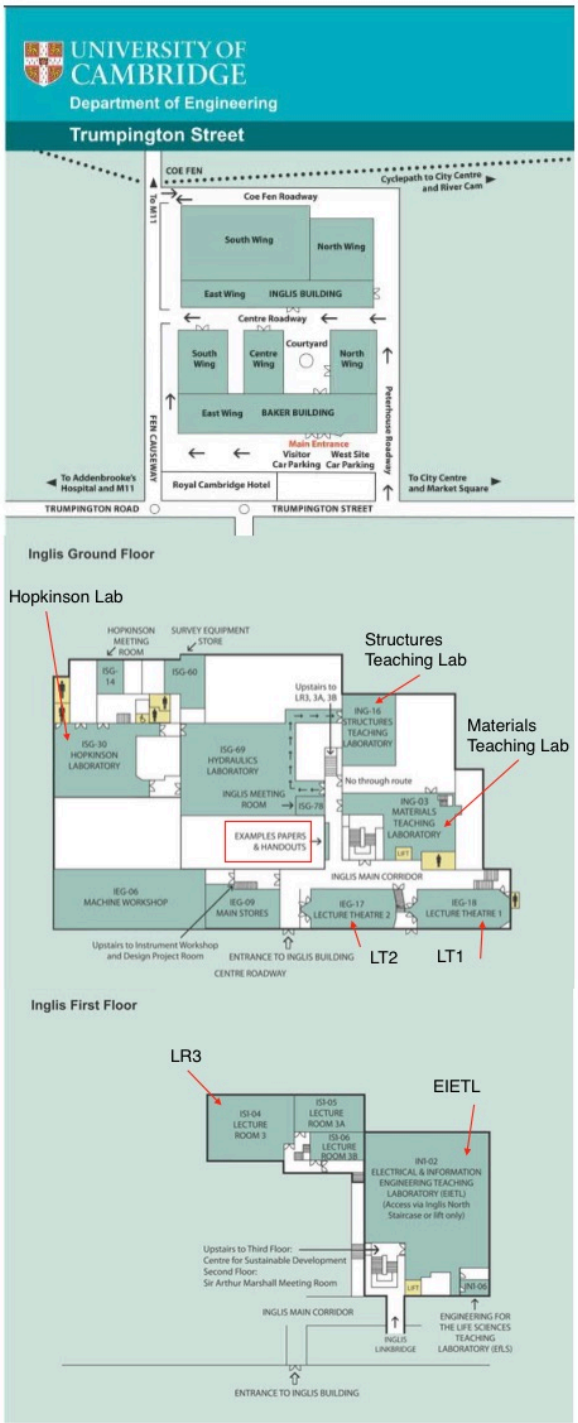
Newcomers Guide 2016

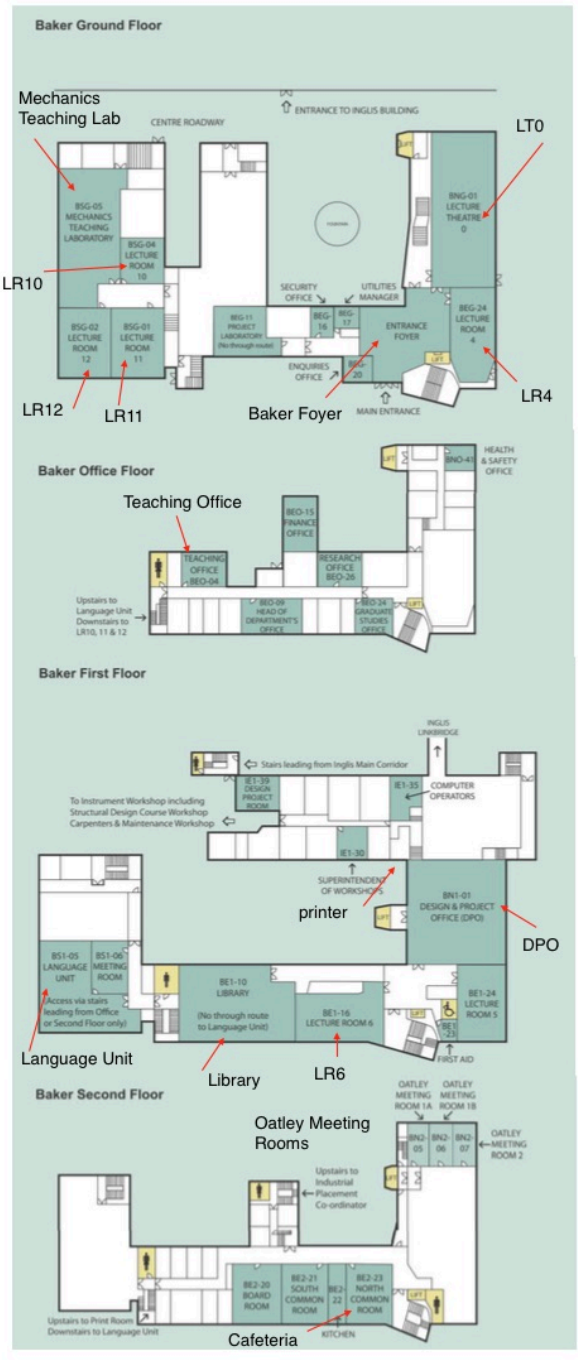


Blue Cambridge Photo by Levin Tan

Cambridge University Engineering Department Map

Note that this plan doesn't show the James Dyson Building, the Dyson Creativity Centre and the bridge between this and the library that have just opened: new maps are now being drawn





Cambridge University Engineering Department

The Department of Engineering is the largest department at the University of Cambridge and one of the leading centres of engineering in the world. Renowned for both its teaching and its research, the Department's aim is to address the world's most pressing challenges with science and technology. To achieve this aim, the Department collaborates with other disciplines, institutions, companies and entrepreneurs. The Department's strength lies in its integrated approach to research and teaching; the unique way in which it applies its capability across all aspects of engineering and gathers partners to find solutions.

Since its foundation in 1875, the Department has grown to become about 10% of Cambridge University and is the largest integrated engineering department in the UK with nearly 200 academics and principal investigators, 300 contract research staff and research fellows, 900 graduate students, and 1200 undergraduates.

Internationally, Cambridge leads the Times Higher Education Rankings for Engineering and Technology (2014-15) outside the USA, jockeying for pole position among the top four American institutions. The REF2014 assessment of UK research showed that Cambridge has the greatest concentration of world-leading engineering research in the country and the best environment for engineering research with a perfect score unrivalled by any other general engineering submission. The combination of academic excellence and a superb environment enabled Cambridge to deliver the highest concentration of world-leading impact in general engineering, creating real benefits to industry and society more widely.

Professor Dame Ann Dowling: Silent Aircraft. Photo courtesy Engineering at Cambridge.

The Department consists of six divisions, comprising teams and facilities that maintain and develop leading positions in research and teaching in the different engineering disciplines:

a. Energy, fluid mechanics and turbomachinery - build on research in fluid mechanics and thermodynamics to develop a systems view of energy generation and utilisation, particularly in ground and air transport, to mitigate environmental impact.

b. Electrical engineering - pursue fundamental electrical, electronic and photonic research at the material, device and system levels with a focus on creating integrated solutions in the fields of nanotechnology, sensing, energy generation, energy conversion, displays and communications.
c. Mechanics, materials and design - extend fundamental and applied research in mechanics, materials, and design, exploiting cross-disciplinary partnerships across the University; and build on existing strengths to develop excellence in bioengineering and healthcare systems research.
d. Civil engineering - advance the mechanics of civil and structural engineering systems within the broader context of the design, construction and operation of sustainable infrastructure and the stewardship of Earth's resources and environment.
e. Manufacturing and management - develop new understanding of manufacturing technology, operations, strategy and policy, in close partnership with industry, in order to improve industrial performance.
f. Information engineering - develop fundamental theory and applications relating to the generation, distribution, analysis and use of information in engineering and biological systems.

Teaching

The undergraduate course is based in the Engineering Department at Trumpington Street. It is delivered mainly through lectures, reinforced and illustrated by laboratory sessions and classes. The first two years are combined engineering and you do all subjects. For the final two years you can choose to specialise in what interests you most: you can focus narrowly on an engineering area, or take a wider range of subjects if you wish.

All the course material and administrative documents are available on-line. It's not always easy to find, but everything is there somewhere! The best way to locate what you're looking for is often to go to the 'Current undergraduates' webpage (purple) and to use the search box. Course material is all on Moodle (the Virtual Learning Environment used in the University).

Bicycle wheel Mechanics demonstration

Photo by Quang Ha

Lectures

Lectures basically contain all the material you need in the course. They last 50 minutes (generally starting at 5 minutes past the hour) and are fast-paced and intensive. You're provided with a fairly-complete set of lecture notes which have some gaps for things like equations, key words and diagrams that you fill in during the lecture: all the notes should be available on-line on the Moodle site for each course. Some lecturers liven up their lectures by interspersing the talking with demonstrations and video clips, but lectures are hard work and you really have to concentrate. Lectures are a very efficient way of find out what you're expected to learn for the exams. Go to the lectures, read and understand the notes, work through the examples papers and you'll be in good shape to do well!

Most lecture courses in the first two years are for everyone together in the big lecture theatre, LT0, which seats 360. Although lecturers won't mind you sticking your hand up and asking for clarification during a lecture, this takes some nerve in such a big class and most people prefer to ask more privately. You can go up to the lecturer afterwards and ask quick questions, or ask through the web-based Fast Feedback, or ask your supervisor for that subject. If the lecturer is going too fast, or doing something else wrong (e.g. you can't read their writing) then tell them!

Large lecture room.

Photo by Quang Ha.

Coursework

Coursework refers to the series of experiments, essays and projects that you do during the year. For undergraduates it accounts for over 10% of the final grade in the first year, and more in later years of the course. In the first two years, coursework is for "standard credit": you get full marks as long as you turn up at every lab and do conscientious work. In later parts of the course you're formally assessed on your written work, and it counts towards your exam mark.

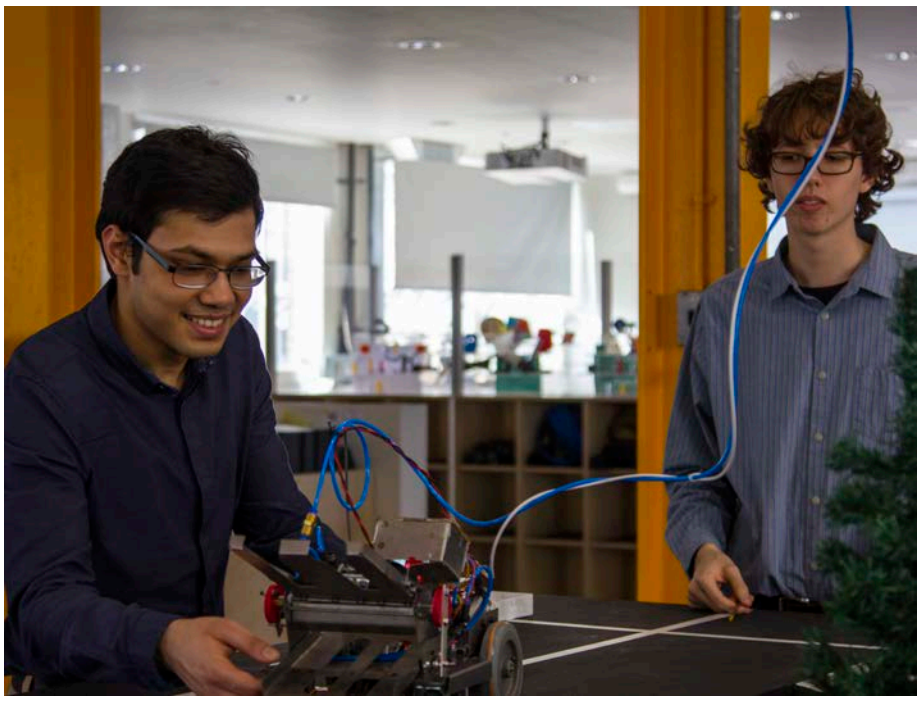
With all coursework, it's important to keep in perspective the number of marks you can get for it and so the time you should spend. Some things are fun (yes, really!) and you find you're

spending hours on them - particularly some of the project work where you're working in teams on more open-ended problems.

The coursework in the first two years is a combination of short experiments and exercises, and more open-ended project work. The short experiments involve 2h in the lab doing something hands-on, and some of these you write up as reports which are marked. Exercises include computing and drawing (engineering drawing both by hand and using computer-aided design packages). The project work is what most students enjoy most and remember best.

In the first year one of your projects is the Part 1A Structural Design Project. You and your lab partner get to design and build a cantilever or bridge out of steel or aluminium, and then apply a brutal load and watch it tear itself to pieces! It's a little daunting if you've never done much metalworking before, but you'll be shown all the techniques necessary, and the workshop technicians are very helpful if you get into difficulties.

In the second year there is the Integrated Design Project, the IDP, where you build a mobile robot to perform a task. You do this in a team of six, and you have to demonstrate some project management ability as well as learning the technical skills to design and build the robot. Getting both your robot and your team members to obey orders and complete the task is quite a challenge, but it's a great feeling when it all works!



IDP Photo courtesy of
Engineering at Cambridge

Examples papers

Examples papers drive your work and form the centre of your studies. They are handed out by lecturers and are sheets of problems intended to ensure you fully understand the lecture material and are able to apply your knowledge correctly. The papers often include some questions from previous years' exam papers (exams are known as Tripos), and are an essential part of the course. Examples papers together with additional Tripos questions will provide the foundation for your revision.

Everything you need to know in order to finish an examples paper is in the relevant lecture notes. However, if you understand a basic principle but are having trouble applying it to problems then you may find it useful to get a different perspective on the work by consulting text books or searching for web resources.

If you have difficulty with a paper, discuss it with friends, supervision partners, and your supervisor. There are worked answers, cribs, available, but don't be tempted to look at them before you've had a really good go at doing the questions. You can fool yourself into believing that you understand something if you just read it through, but you can't be certain until you work it through yourself. Even better can be to explain it to someone else, so helping them as well as yourself!

Supervisions

Supervisions are one-hour sessions, usually two students with an experienced engineer, who can be anyone from a postgraduate student to a Nobel Prize-winning professor, during which you discuss your attempts at examples papers and any other aspects of the course in which you may have problems. These sessions can be a lifeline in the Cambridge course. You will have opportunity to clarify any queries or uncertainties you have about the course, and consolidate your understanding of concepts.

Remember that supervisions are informal and are there to help you rather than being part of the assessment. You normally get about one supervision a fortnight in each subject, so you have two (or sometimes three) supervisions per week. Make the most of them! Do as much as you can of the examples paper before the supervision, and agree with your supervision partner what you want to get out of the supervision. Don't be afraid to let the supervisor know if you're having problems: it is their job to guide you through the course. If the supervisor isn't able to provide the assistance you need, then talk to your College Director of Studies (DoS).

If you are finding the work difficult, or you don't feel you can work fast enough and are having genuine difficulty keeping up-to-date and comprehending the material, let your supervisors know. If you don't, they may think you're just being lazy. But if they know you're trying your best, they will be sympathetic and will work hard to help you.

Pouring liquid nitrogen. Photo by Quang Ha

Language Unit

The Department has its own language teaching facility. You can take formal language courses in French, German, Spanish, Chinese or Japanese, or you can use the private study resources to brush up your skills or to teach yourself new languages. The staff are always very helpful and the atmosphere in the Unit is relaxed.

Library

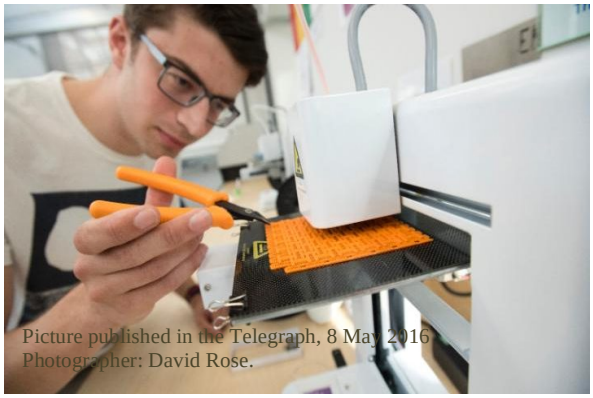
The Department Library is staffed between 9am and 5pm Monday to Friday all year round, except for a week or so at Christmas. It has recently been refurbished and now provides dedicated spaces for silent study and for collaboration. After hours it is open on a trust basis – i.e. put the books back where you found them when you're done!

The library staff are incredibly helpful so don't hesitate to ask them if you can't find what you need. They can advise on a wide range of information-related topics, from literature searching and evaluating the information you've found to reference management and structuring your essay. Keep an eye on their emails about new resources, training sessions and drop-in clinics and suggest new services and developments by commenting on their feedback wall.

Student team discussing their Lego robot in the Collaborative Space in the library

Dyson Centre for Engineering Design

The Dyson Centre for is a modern workspace for students to develop their creativity and enthusiasm for engineering, providing a home for extra-curricular student-led engineering projects, both team and personal projects, as well as design, build and test projects of the teaching programme.


Picture published in the Telegraph, 8 May 2016
Photographer: David Rose.

Students can come together to think, exchange ideas, design, experiment and build. Access is provided to laser cutters, 3D printers, computer-controlled and manual machine tools, traditional sheet metal working machinery, and 48 bench spaces are for electronics and mechanics work.


Photographer: Quang Ha

It is hoped that most engineers will engage in some extra-curricular engineering project work in the Centre at some point during their four years in Cambridge, with this being a good way to enhance your portfolio beyond the largely theoretical skills which the course will teach you.

Student Societies, Teams, Groups and Clubs

Student-led projects at Cambridge University Engineering Department showcase the initiative, technical brilliance and teamwork of our students. The projects are of great value in terms of educational and personal growth of the students, seizing public imagination around the world, raising the profile of modern engineering and developing some really creative engineering solutions.

Funding for student teams is available from the Student-Led Projects and Industrial Partnership (SPIP), which is currently supported by the following organisations:

BOEING bp NATIONAL INSTRUMENTS JAGUAR LAND ROVER

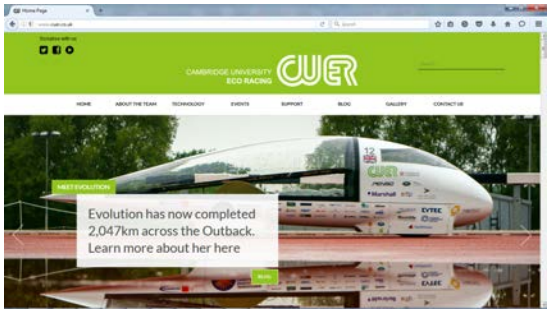
SPIP events allow for teams to present their recent achievements and bid for SPIP funding in a Dragons' Den style event. For more information, visit

www.dysoncentre.eng.cam.ac.uk/spip-expo

Some other funding sources for team and personal projects are given on
http://www.dysoncentre.eng.cam.ac.uk/funding

Some of the projects are described in the following pages. For complete lists and more information, look on the Dyson Centre webpages:

http://www.dysoncentre.eng.cam.ac.uk/



http://www.cuer.co.uk/

Cambridge University Eco Racing (CUER)

60 strong student organisation that designs, build and races solar powered vehicles. Founded in 2007, they race in the World Solar Challenge, the world's foremost solar endurance race, held in Australia. Team mission is to inspire as well as innovate, leading to outreach programs, both nationally and internationally. Recent highlights include attendance at the Gadget Show Live and High Performance event at the London Science Museum.

http://www.fullblueracing.co.uk/

Full Blue Racing (FBR)

FBR is the Formula Student team of the University of Cambridge. Established in 2006, FBR is a team of around 30 students who, every year, design and build a single seater racing car from scratch, then compete against universities from around the world at the international Formula Student competition. Formula student teams are not only evaluated on speed and handling of the car, but also on business, costing and design presentations

https://www.facebook.com/CambsRobogals

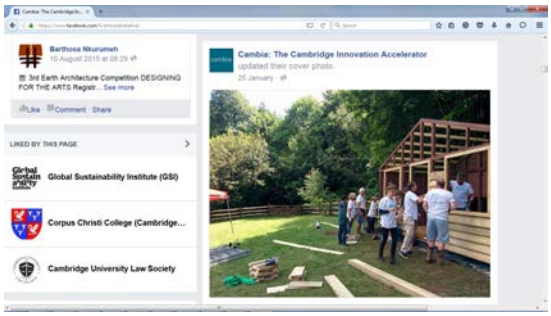
Cambridge Robogals

Aimed at both male and female members of the Engineering Department, the Cambridge chapter of global organisation Robogals aims to substantially increase the number of young women pursuing engineering in tertiary studies and careers, as only 9% of engineers in the UK workforce are women. Through robotics outreach events, they hope to bring engineering into the vocabulary of school students, and show them how fun and rewarding it can be. For more information visit http://www.robogals.org/

http://cdi.soc.srcf.net

Cambridge Development Initiative (CDI): Engineering

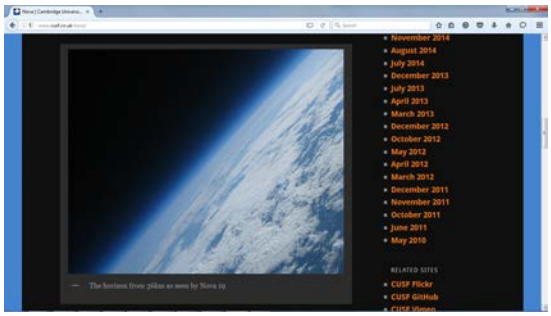
CDI works on solving international development problems, focussing in particular on trying to catalyse sustainable change in Dar es Salaam. Recent products: a waste evaporator to produce fertilizer and drinking water; part of the world's first integrated simplified waste and biogas system. Recent highlights: House of Lords CDI event - "What role can students play in achieving the Sustainable Development Goals?"



https://www.facebook.com/EcoHouseInitiative

Cambridge EcoHouse Initiative

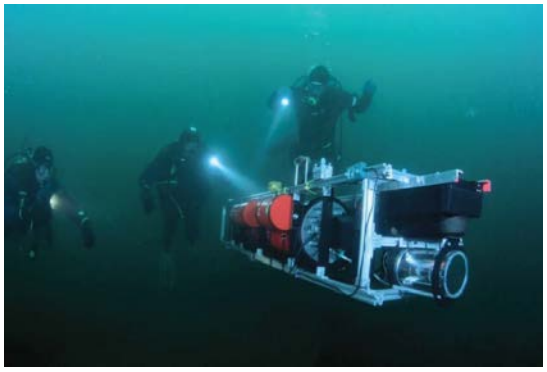
Cambridge EcoHouse is a student-led initiative that designs sustainable technologies to reduce urban poverty, primarily in Latin America. Recent activity in the Dyson Centre has seen structural testing of the final iteration of the modular wooden transitional house design for use in slum communities, which will be constructed for families in Brazil by partner NGO TECHO. Members of Cambridge EcoHouse regularly go to Brazil to assist in such work.



http://www.cusf.co.uk/

Cambridge University Space Flight (CUSF)

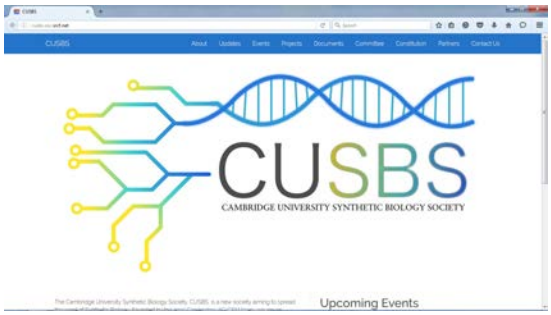
CUSF is a student run society founded in 2006, aiming to develop technology needed to reduce the cost of sub-orbital access to space for scientific research, in the form of high altitude (36km) balloon launches, designing rockets (8km altitude), and other related experiments. Successes include camera images showing the curvature of Earth, during a test flight and collaboration with the European Space Agency to test parachutes. Aims include launching rockets into space for under £1000, and the design of a new hybrid rocket motor. CUSF also offers outreach engagement with local schools. CUSF are always keen to meet new people, especially if you're interested in space, rocketry, electronics or programming.



http://www.cambridgeauv.co.uk/

Cambridge Autonomous Underwater Vehicle (CAUV)

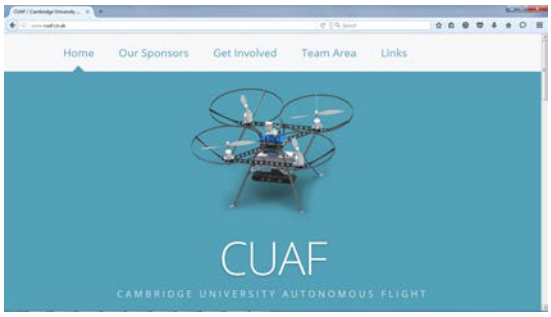
CAUV develops designs and manufactures unmanned underwater vehicles for science and exploration. The submarines are designed to operate in shallow water (<80m), performing a variety of underwater tasks with innovative ideas and technologies. Founded in 2006, four unique AUVs have been designed and built since then. 'Barracuda', completed in July 2012, won the 2013 Students Autonomous Underwater Challenge – Europe (SAUC-E) competition. Typical activities include machining mechanical components, creating circuit boards and developing embedded software systems to make the vehicle act autonomously when it is put in the ocean.



http://cusbs.soc.srcf.net/

Cambridge University Synthetic Biology Society (CUSBS)

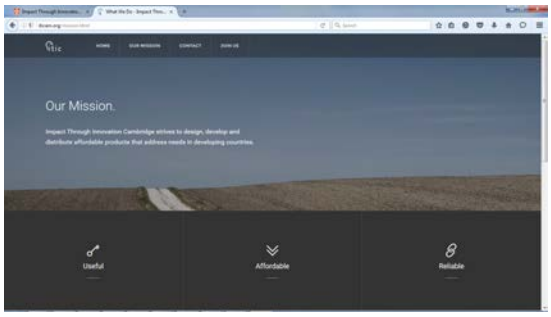
Founded in 2015, CUSBS aims to promote the field of synthetic biology amongst the student community and, via outreach work, within schools in Cambridge. The main focus is developing bio-hardware, and ultimately its output will be well-documented, open-source and low-cost scientific tools for use either in labs or as educational aids. Students work on projects in teams over the course of six months, involved in all aspects of projects from design and construction through to testing.



http://www.cuaf.co.uk/

Cambridge University Autonomous Flight (CUAF)

CUAF is a student society dedicated to the design, construction and operation of small aerial vehicles such as quad-rotor drones. For the last few years it has participated in the International Micro Air Vehicle (IMAV) conference and competition held in various locations across Europe.

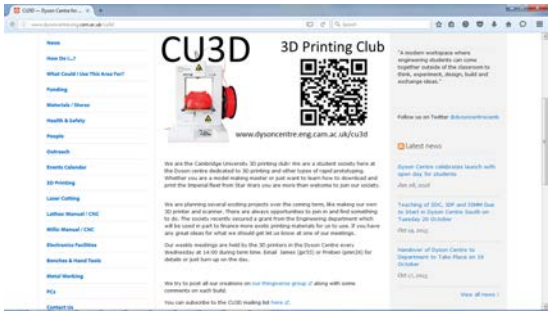


http://iticam.org/

Impact Through Innovation Cambridge (ITIC)

Team mission: Impact Through Innovation Cambridge strives to design, develop and distribute affordable products that address needs in developing countries.

Research team members explore the actual needs that people have in developing countries. Development team members design products based on the conducted research, considering different strategies in order to achieve a product that is affordable and reliable.



http://www.dysoncentre.eng.cam.ac.uk/cu3d

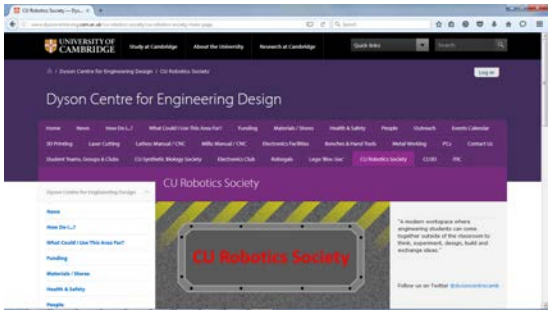
Cambridge University 3D Printing Club (CU3D)

Formed in February 2016, CU3D is a student society at the Dyson Centre dedicated to 3D printing, other types of rapid prototyping, and 3D scanning.

http://www.dysoncentre.eng.cam.ac.uk/electronics-club

Electronics Club

Formed in January 2016, Electronics Club is a group which meets weekly to work on projects, both personal and course-related, exchanging ideas and advice, and offering help on printed circuit board design, and more specialised areas (use of surface mount parts, hot air rework, reflow soldering, RF electronics, real-time operating systems).



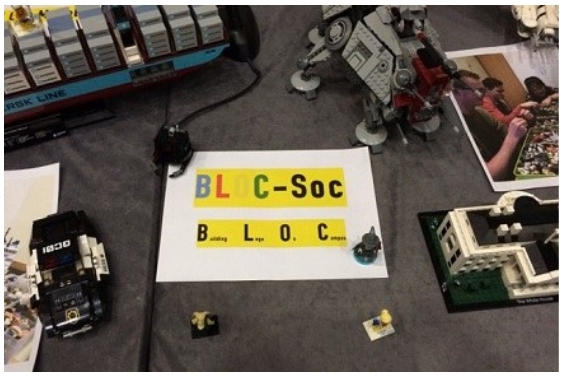
http://www.dysoncentre.eng.cam.ac.uk/curs

Cambridge University Robotics Society (CURS)

CURS is a society which is barely a few months old, having been formed at an initial meeting on 14 January 2016, with around 50 expressions of interest.

The aims of the group include inclusion in various national and international competitive robotics events.

The group has recently secured amounts of funding to allow its activities to commence.



http://www.dysoncentre.eng.cam.ac.uk/bloc-soc

Lego 'Bloc-Soc'

BLOC-Soc is a creative building society dedicated to the use of Lego Bricks and Lego Mindstorms kit, involving creative building challenges, planned projects, robotics and problem solving. Recent projects have included a self-balancing Segway and a Wild West Style shoot-em-up game. We welcome students of all ages and abilities - whether you are a budding structural engineer, clever coder, brilliant builder or just want to play around with some bricks. No previous experience necessary and a great way to make meet new people. Come along and try it out for yourself!

Engineering Outreach and Getting Involved

Outreach at the Department of Engineering aims to introduce school children to the fun and excitement of engineering within a university research environment. Teams of student volunteers are given the chance to make engineering more accessible through activities such as public lectures, summer schools for A-level students, workshops aimed at Primary School children and a huge flagship event for Cambridge Science Festival at the end of lent term. Last year, over 2000 young people and parents participated in one of our outreach events.

Typically, volunteers help small groups of young people in a 'design, build and test' activity, e.g. building a rocket launch pad. There is no set time commitment for volunteers; you can volunteer for as many or as few activities as fits in with your other interests and studies. To find out about events as they happen, email outreach-officer@eng.cam.ac.uk and ask to join the Outreach mailing list.

Notebook information provided by students and staff

Cambridge University Engineering Department, May 2016

http://www.eng.cam.ac.uk/