




Academic Scheme Pack

CL Global Cambridge Programme

Engineering Course

I. Institution Introductions

Hosting Cambridge Colleges Introduction

Cambridge Colleges are the setting for CL Global Cambridge Summer Programmes, providing the opportunity to experience Cambridge college life.

Corpus Christi College, Cambridge

Corpus Christi College, one of the oldest colleges in Cambridge, was built in 1352 by Guilds of Corpus Christi and the Blessed Virgin Mary.

St Catharine's College, Cambridge

St Catharine's College was officially founded on St Catharine's Day on November 25th in 1473. It was originally named "Katharine Hall."

Lucy Cavendish College, Cambridge

Lucy Cavendish was established in 1965 and is one of three women's colleges in Cambridge. The college is named in honour of Lucy Cavendish, who campaigned for the reform of women's education.

CL Global

CL Global is an education company aiming to promote global learning and culture exchange. Having taken several thousand students to see the world, we are on a mission to make our academic programmes the best local experience for students. Besides Cambridge, we also run programmes in the US, Italy, Japan, and China. CL Global is accredited by the British Accreditation Council as a Short Course provider.

We believe in the power of connecting and sharing. We are a group of millennials with passion to build connections through education.

II. Course Structure

The programme is designed to complement the students' home university curriculum, offering an opportunity for students to gain in-depth understanding from international experts while enjoying **College Life in Cambridge.**

The Course contains three specialized modules and one humanities module. The classes and supervisions add up to **45 Contact Hours** during the **3-Week Programme**. The core course modules are specified in the chart attached below. Learning beyond the classroom includes an organization visit and local cultural experiences. For information about **Customized Programmes** adapted to the students' background, module topics could be discussed in further detail.

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III. Course Outline

Lectures
The core

Lectures are the foundation of the course and typically last around a half-day with two short breaks. Lecturers are leading faculty members and academics from Cambridge and Oxford working at the forefront of their fields.

Supervisions
In-depth exploration

This system of more personal tuition is one of the greatest strengths of teaching in Cambridge. Supervisions provide the opportunity to explore the subject more deeply, discuss questions and ideas, and receive feedback.

- Supervisions are small-group sessions that are organised by PhD researchers in the field.
- Students undertake preparation for each supervision -- usually reading, writing, or working on problem sets.

Practicals
Hands-on

In practicals, professors guide students in applying the knowledge they have learned from lectures. In the engineering course modules, students participate in a lab session. The business courses use case studies to engage students in discussion on real scenarios. In the humanities course, students apply their skills through a seminar or workshop.

Organization visits
On-site

The course includes the opportunity to learn outside the classroom through an organization visit. The visit provides context for the course concepts and helps students expand their understanding of how academic knowledge can be applied in real life situations.

IV. Course Facts

Entry Requirements
English Language: Selection process will be fully given to universities. It's recommended that selected students have the level of English equivalent to IELTS 6.5 / TOEFL 80 or above.
Prerequisite: Some courses will require prerequisite knowledge of certain areas or subjects.

Study Hours
Duration: Three weeks
Contact Time: Minimum of 45 hours; Lecture: 33 hours; Supervision: 6 hours; Organization Visit: 3 hours; Group task:3 hours. (Some course schedules vary)
Recommended Self-study: Minimum of 10 hours of self-study per module, including required course material, pre- reading, and preparation of group projects.

Assessment and Transcript
Assessment: Depending on the nature of the course, assessment will take the form of a project presentation, written exam or course work.
Transcript: The course transcript will be given at the end of the programme with the assessment results. Granting credit is up to the home university.

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V. Course Details

I Core Modules

Nanotechnology

Overview

Nanotechnology, or Small is good. We will take a look at Nanotechnology in everyday use, gain an understanding of the basic underpinning principles and see where this exciting field is heading. We will start by looking at the origins of nanotechnology, deep in the mists of time when science thought it had all the answers, and then it became clear from one discovery after another that this was not the case. From Quantum mechanics to relativity, science was shaken at its roots over a century ago, and this led to the interest in all things small. We will then look at what nanotechnology really is, and how and why the properties of nanometer-sized objects are fundamentally different to larger things, and how we can take advantage of this. We will look at specific examples of nanotechnology applications in healthcare, electronics, textiles, defence, automotive industry, fuels, food, etc. We will also look at how we explore the properties of nanometer sized things, and get some hands-on experience with scanning probe microscopes that are used to image things at these length scales.

Materials and Sustainability

Overview

The evolution of materials through the history of mankind is deeply interlinked to man's impact on the environment. Materials and products will also play a substantial role in building a sustainable future in reducing energy use, mitigating emissions, and managing solid waste.

The course is divided into two main sections. The first section will discuss how to design products keeping sustainability in mind. The second section will introduce you to classes of advanced materials, including natural and composite materials, which have potential to help us in meeting sustainability targets.
The course will start with an overview of global production and consumption of materials and their impact on the environment. We will introduce ideas including the 'life-cycle' of a product, and how to use 'life cycle assessment' as a tool to quantify environmental impact, and inform better decision-making in material and process selection, and product design. This will be complemented by exploring the use of materials selection charts and also explore eco-auditing tools on the Cambridge CES Selector software.
In the next section, we will begin by understanding how (and why) we can use nature as an inspiration to design for sustainability. We will use spider silk and wood as case study 'model' materials. We will also explore how biocomposites are offering new opportunities in various engineering applications. Finally, by conducting a simple life cycle assessment, we will explore whether all green materials are really green.

Renewable Electrical Power

Overview

This course will start with an overview of the various technologies that underpin the generation of electricity from renewable sources, and explain the relative importance of each technology.

Wind power is by far the most rapidly increasing contributor to renewably-produced electricity, and so the rest of the course will focus on the science and engineering of wind turbines. We will also consider the economics of running a wind farm to achieve optimal financial return.

Finally, through a group assignment, we will look at applying the course material to consider which of four alternative systems leads to the best return on investment: offshore fixed speed turbines; offshore variable speed turbines; onshore fixed speed turbines; onshore variable speed turbines. Each group will give a short presentation at the end of the course to disseminate their findings.

Semiconductor Engineering

Overview

The lectures would be on the following topics:

- The pn Junction Diode
- Current Flow in the P+n Junction
- Metal-Semiconductor Junctions
- The BJT & HBT
- The MOSFET (Part 1)
- The MOSFET (Part 2)

The students are expected to answer a short quiz after the course to assess their understanding of the topics covered.

Prerequisites

The students should already have an understanding of basic semiconductors, including the band gap, Fermi Energy, effective density of states in the Conduction and Valence Bands, and carrier concentrations in the conduction and valence bands.

Applied Information Theory

Overview

This course will introduce the concepts of information theory, data compression and error correction that are essential building blocks in the design of communication and storage systems. We will review the probability theory of discrete random variables, introduce fundamental measures of uncertainty and information, and derive the fundamental limits of communication and storage. Furthermore, we will learn a number of practical compression and error control algorithms that enable operation close to the theoretical limits. An outline of the material to be taught is as follows:

- review of discrete probability theory
- entropy, uncertainty
- fundamental limits of data compression
- Huffman coding and arithmetic coding
- mutual information
- fundamental limits of reliable transmission / storage
- linear codes
- low-density parity-check codes

Computer Science & Technology

Introduction to Computer Science

Computer science is the study of the theory, experimentation, and engineering that form the basis for the design and use of computers. It is the scientific and practical approach to computation and its applications and the systematic study of the feasibility, structure, expression, and mechanization of the methodical procedures (or algorithms) that underlie the acquisition, representation, processing, storage, communication of, and access to information. An alternate, more succinct definition of computer science is the study of automating algorithmic processes that scale. A computer scientist specializes in the theory of computation and the design of computational systems.

Big Data

Modern technology allows for the collection of immense volumes of data. The challenge of converting these data into useful and actionable information is an activity known as data science, or "Big Data". The datasets that research now handles are not only large, but complex, containing unstructured, heterogeneous data, human language, image and video, and completely new approaches are required to handle them. From physics to the life sciences, from image analysis to social networks, the challenges in managing and analysing large and high-dimensional datasets require increasingly interdisciplinary work.

Artificial Intelligence

Artificial Intelligence is multi-disciplinary, spanning genomics and bio-informatics, computational learning theory, computer vision, and informal reasoning. A unifying theme is understanding multi-scale pattern recognition problems, seeking powerful (often statistical) algorithms for modeling and solving them, and for learning from data.

II Humanities Modules

Shakespeare

The Shakespeare Syllabus

Classes will involve reading and understanding Shakespeare's original text, working in small groups with other students, and dramatic performance.

Shakespeare Class 1: 'A drum, a drum! Macbeth doth come!' Introduction to Shakespeare's language and the plot of the play Macbeth

Shakespeare Class 2: 'If it were done when tis done, 'twere well it were done quickly...'
Close study of an important speech by the central character, Macbeth, to understand language and character

Shakespeare Class 3: 'Fair is foul and foul is fair' The three witches: understanding and performing the opening scene of Macbeth
Shakespeare Class 4: 'Screw your courage to the sticking-place and we'll not fail' Studying and representing the relationship between Macbeth and Lady Macbeth

English Poetry

The Poetry Syllabus

This short course will enable students to engage with real poetry in English, both serious and light-hearted, by linking awareness of language with classic examples of verse from the late 16th century to the present. There will be individual and group exercises that draw attention to important features of verse, and the chance to analyse more deeply and reflect on the power of poetry.

Depending on student progress and interest there will be some flexibility about exactly which poems are studied in class and which will be given as suggested extension activities.

Poetry Class 1: The heart of the matter An introduction to basic features of poetry in English, looking at ideas, rhyme and rhythm.

Poetry Class 2: Listen up
Cementing the features from class 1, adding some other language effects that are about sound in particular, and considering the relationship between humanities and the natural world in two classic lyric poems.

Poetry Class 3: Look closely
Considering how visual form relates to meaning in examples of "shape poetry". Some essential cultural background.

Poetry Class 4: Get Donne done Analysis of and response to a famous sonnet from the age of Shakespeare.

III Organization Visit

BMW MINI Plant Tour

Plant Oxford is the birthplace and heart of MINI production. Manufactured to individual customer specifications, hundreds of MINIs leave the plant’s assembly lines each day, off to meet new owners in more than 110 countries around the world.

Three UK plants have had a part to play in MINI production – Plant Hams Hall makes engines, Plant Swindon produces body pressings and sub-assemblies for MINI, and all this comes together at Plant Oxford with body shell production, paint and final assembly.

Since production of the new MINI started in 2001, almost 3 million cars have been made at Plant Oxford. But the plant's heritage goes back much further than that – it is a site with 100 years of automotive manufacturing history, which has become a landmark in the "city of dreaming spires".

The Cavendish Laboratory, Department of Physics

The Cavendish Laboratory has an extraordinary history of discovery and innovation in Physics since its opening in 1874 under the direction of James Clerk Maxwell, the University's first Cavendish Professor of Experimental Physics. Up till that time, physics meant theoretical physics and was regarded as the province of the mathematicians. The outstanding experimental contributions of Isaac Newton, Thomas Young and George Gabriel Stokes were all carried out in their colleges. The need for the practical training of scientists and engineers was emphasised by the success of the Great Exhibition of 1851 and the requirements of an industrial society. The foundation of the Natural Sciences Tripos in 1851 set the scene for the need to build dedicated experimental physics laboratories and this was achieved through the generosity of the Chancellor of the University, William Cavendish, the Seventh Duke of Devonshire. He provided £6,300 to meet the costs of building a physics laboratory, on condition that the Colleges provided the funding for a Professorship of Experimental Physics. This led to the appointment of Maxwell as the first Cavendish professor.

Since the founding of the Nobel Prizes by Alfred Nobel in 1895, **29 members** of the Cavendish have won one of the illustrious prizes. Note that not all of the Prizes are in physics.

The next phase of development is the reconstruction of the Laboratory to meet the challenges of the 21st century. The necessary major redevelopment programme continues the tradition of innovation and originality that has been at the heart of the Laboratory's programme since its foundation.