

Summer Institute

- Online Programme -

About the Programme:

The *Summer Institute* here at Oriel College Oxford is an exclusive study abroad programme offered by Oriel College, one of the constituent colleges of the University of Oxford.



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Closest Oxford
and Cambridge
experience
possible

The *Online Programme*, a new form of the academic offering of the Summer Institute here at Oriel College Oxford, provides delegates from all over the world with a unique opportunity to experience the world's most renowned academia from anywhere.

Highlights

- ✧ Elite academics from the University of Oxford and the University of Cambridge
- ✧ Easy access to online courses from any corner of the world
- ✧ A wide selection of courses from a range of tracks.
- ✧ Immersive academic experience
- ✧ An authentic taste of studying at Oxford
- ✧ Credits earned (3 ECTS/1.5 US Credits per course)

Session Dates

- ✧ Session 1: 11 January – 22 January 2021
- ✧ Session 2: 25 January – 5 February 2021
- ✧ Session 3: 15 February – 26 February 2021

Certificate of Attendance & Academic Transcript

After completion of a 2-week session, delegates will receive a Certificate of Achievement and an Academic Transcript issued by Oriel College, Oxford in partnership with WorldStrides | CBL International.

Accreditation

We are proud to announce that the *Summer Institute* here at Oriel College Oxford offered by Oriel College in partnership with WorldStrides | CBL International is accredited by the British Accreditation Council.



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Structure of the Online Programme

Delegates can participate in one course within two weeks. Each two-week session consists of one full course of academic lectures, evening talks, an orientation and a graduation ceremony. All lectures are delivered by renowned academics from the University of Oxford and Cambridge, or affiliated to both universities.

Available Courses (select 1 or 2 for each two-week session)

Science & Medicine

- ✧ Microelectronic Circuits and Analogue Device
- ✧ Cryogenic Engineering: Cryocoolers for Space
- ✧ The Health of Nations: Current Challenge and Future Possibilities
- ✧ Quantum Computing
- ✧ Introduction of Nanomaterial
- ✧ Dynamic Behaviour of Material
- ✧ Stem Cell Biology: Embryonic and Adult Stem Cells

Economics & Business

- ✧ Entrepreneurship: Evaluation Creation and Funding of New Ventures
- ✧ Economics of Industry: Strategic Choices, Market Concentration, and Competition Policy

PPE & International Politics

- ✧ International Governance of the Future
- ✧ Contemporary PPE – Ethics and Logic

Course Description

Microelectronic Circuits and Analogue Device

This course provides a brief yet comprehensive description of standard electronic devices and circuits. It starts with a look at the electrical properties of semiconductors, highlighting the difference with insulator and metals and how these properties can be exploited to create active devices.

The focus will then shift to the most common device used for consumable electronics: the MOSFET, looking at its transfer characteristic and its properties as a controllable switch as well as the problems induced by the size reduction achieved throughout the years.

The second half of the course will then look at how the MOSFET can be used to create the building blocks of a combinatorial circuit able to perform logic and binary operations. Starting from the simplest logic circuit – an inverter – more articulated configurations will be analysed throughout the lessons reaching a full adder to perform binary summation on an arbitrary number of bits. Finally, the course will also briefly discuss the memory elements required to achieve a sequential circuit with memory of its previous state.

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Every calculator can be seen as a collection of sequential and combinatorial circuits interacting with each other, so understanding them is a first important milestone towards a deeper comprehension of more complex configurations e.g. CPUs and GPUs.

Cryogenic Engineering: Cryocoolers for Space

Cryocoolers are low temperature (below 120 K) refrigerators that provide cooling for electronic devices such as infra-red detectors and superconducting devices. The operation of cryocoolers involves complex thermodynamics which are not always intuitively understood. In this course we will start by going over the first and second laws of thermodynamics and then explore a number of relevant thermodynamic cycles in detail. We will cover the basic principles behind the Stirling, Pulse Tube, Gifford-McMahon, Joule-Thomson and Brayton cryocoolers with a focus on space applications. The performance and the advantages and disadvantages of the cryocoolers will be discussed and current research areas will be presented.

This course will provide an insight into the operation of cryocoolers and their various types and applications. Students will learn about the underlying physics involved in the operation of cryocoolers and will become familiar with some of the challenges faced in cryogenic engineering. Students will understand the advantages and disadvantages of the different types of cryocoolers and will be able to decide on a suitable cryocooler configuration given the application. Students should already have a good level of spoken English and some familiarity with thermodynamics (although this can be quite basic and is revisited in the first lecture).

The Health of Nations: Current Challenge and Future Possibilities

This course will discuss and analyse the state of health in the world and the challenges of the next 20-50 years. In addition, delegates will learn how health financing will need to adapt to the challenges of an aging population. Case studies analysing pandemics, such as SARS, flu, and Ebola, will be looked at in detail. New technologies and health innovations will be explored.

By participating in this course, delegates will gain a deeper understanding of the impact of health challenges, both now and into the next several decades. By looking at relevant and recent case studies, there will be the opportunity to discuss solutions.

Quantum Computing

Quantum computation is a new model of computation. The theory of quantum computing is well understood but a quantum computer still has not been built. Such a computer will be able to factorize numbers quickly and thus make many of our cryptography systems useless.

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In this course we will study what is quantum computation and we will cover several quantum algorithms.

Introduction of Nanomaterial

The course provides essential knowledge on the fundamentals of nanomaterials and their applications in making today's and future devices. The course will define what low-dimensionality is and how the nanomaterials can take various forms. The students will also be able to develop knowledge on the changes in the physical and chemical properties of materials as they go to the nanoscale. The students will explore some examples of nanomaterials such as carbon nanotubes and graphene. The course also provides knowledge on the nanomaterials fabrications and assembly in 3D to produce novel structures that can be used to change the world. The students will also learn about some real-life applications of nanomaterials and the basic science behind them.

Dynamic Behaviour of Material

This course of lectures will introduce students to the effect of rapidly applied loads to different categories of solid materials. The course will focus on direct industrial applications, providing the required tools to fully understand the dynamic behaviour of materials, and how it can be used within the design process of real-life components.

The first part of the course will introduce the concept of dynamic behaviour and wave propagation within solid materials. The different types of elastic waves will be defined, and the analytical representations of the single waves and their interaction with the domain boundaries will be derived. Examples of practical applications of wave propagation mechanics will be shown, from earthquake location to high rate characterisation of materials.

The second part of the course will expand the range of deformation mechanisms by including plastic and shock waves. The different characteristics of elastic and plastic waves, and the effect of permanent deformation of the material will be analysed.

The third and final part of the course will focus on the techniques used to characterise solid materials at different loading rates. Examples of testing techniques using different methods to deliver the load, from gravity (i.e. drop tower) to explosives (e.g. ring expansion tests), will be described to cover an extremely wide range of strain-rates.

The course consists of eight 90-minutes lectures, combining frontal lecture on theoretical aspects and interactive solution of problems relevant to the topic addressed during the lecture.

Students should already have a good level of knowledge of the fundamentals of solid

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mechanics (e.g. definitions of stress and strain and difference between elastic and plastic deformation mechanisms), and basic knowledge of differential calculus.

Stem Cell Biology: Embryonic and Adult Stem Cells

The course is composed in two parts and serves to give delegates a comprehensive overview of the field of stem cell biology. The first part looks at aspects of the development of both embryonic stem cells and adult stem cells, while the second part of the course explores the discovery and biology of induced pluripotent stem cells, and the significance of its applications in revolutionising the future of medicine. Delegates are also introduced to cell trans-differentiation, the programming of one cell type into another such as the conversion of a skin cell into neuron.

Attending students are expected to be at an undergraduate level or higher as lectures will be taught at a University of Cambridge undergraduate standard. A good level of reading and speaking English is also desirable as students are expected to read provided materials and to engage in scientific discussions.

Entrepreneurship: Evaluation Creation and Funding of New Ventures

Entrepreneurship can be defined as the “the pursuit of opportunity without regard to resources currently owned or controlled”. In recent years it has received increasing attention both in the media and an alternative career choice.

This course provides a comprehensive introduction to entrepreneurship and the realities of new venture creation. This is a growing and ever-changing field and this course will balance insights from famous cases and research into the field with the overall aim to provide a foundational knowledge on the practicalities of entrepreneurship. Subjects will include:

- Entrepreneurial behaviour and understand if entrepreneurship is right for you.
- The Cambridge Technology Cluster
- An introduction to entrepreneurship theory – what is it?
- Understanding entrepreneurial opportunities – how do you spot and create high potential opportunities.
- How to harness opportunities – including business models and entrepreneurial finance.
- How do you set up a venture.
- The importance of the team and other ways to mitigate risk.

Economics of Industry: Strategic Choices, Market Concentration, and Competition Policy

The economics of industry is concerned with the behaviour of firms. This course covers both theory and applications. It is based on the final year undergraduate course taught at the University of Oxford.

The objectives of this course are to provide an understanding of:

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- the theoretical foundations of firm decisions regarding pricing, product differentiation, advertising, entry, mergers and takeovers, innovation, vertical integration, and organization
- the welfare implications of firm behaviour
- strategic firm behaviour, its effects on other firms
- inappropriate firm behaviour and the design of public policy responses
- methods of determining and analysing firm behaviour through the use of data

International Governance of the Future

The main purpose of this course is to expose students to emerging topics in International Governance, topics that their generation will have to engage with and address effectively. As many of our students aim to become practitioners working in the field of International Affairs and Public Policy, this course is preparing them for their careers by exposing them to a wide range of emerging International Governance issues: the digitalisation of society and international affairs; the effects of artificial intelligence on the international job market and international migration; environmental degradation and effective management of depleting natural resources. These are issues that are not only considered by scholars and policy experts as due to grow in importance, but also issues that are of interest and currently cause concern to students and young people. This year we saw massive mobilisation of students and youngsters around the world demanding international and firm action on climate change. The reading list exposes students to both academic literature and to policy studies, published by well-established policy institutions.

The course includes a series of lectures (that introduce students to the emerging issues in International Governance mentioned above) and a wide range of class activities that will allow students to gain a better understanding on the subjects covered and develop a wide range of skills (analysing qualitative and quantitative data, cooperating with others, working as part of a team/ group, communicating effectively, etc.).

The course aims to help develop the students' negotiation skills and, in this regard, it will include several micro and macro simulations. During these simulations, students will play the role of diplomats, policymakers and various stakeholders that are called to find and negotiate solutions and international agreements addressing e-commerce, the rise of artificial intelligence, new forms of migration, the need for sustainable energy, climate change, etc.

PPE – Ethics and Logic

Since its beginnings in ancient Greece, the Western philosophical reflection on how we should conduct our lives, ethics, has been closely intertwined with the inquiry into logos, 'reason' or 'reason-ing', practical and theoretical, human or divine. While ethics and logic have developed into two distinct sub-disciplines of philosophy, different philosophical approaches

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to normative ethics and meta-ethics are often best understood as springing forth from different conceptions of the role that reason and argument (ought to) play in human morality, and from different assessments of the validity of certain key arguments (or alleged 'fallacies') in ethics, and of the force and implications of certain 'dilemmas' or 'paradoxes'. Competing ethical theories are typically construed dialectically: they argue for the deficiency of the rival theories, and defend themselves by denouncing the shortcomings in the logic of their critics.

Through a selection of texts and case studies drawn from the history of Western philosophical ethics (including Plato, Aristotle, the Stoics, Hume, Kant, Mill, Moore, Mackie), this course will offer a perspective on how ethical discourse and debate were and remain deeply informed by the language and tools of logic.

Faculty

Associate Professor Kobi Kremnitzer, Oriel College, University of Oxford (UK)
Dr. Amin Abolghasemi, Oriel College, University of Oxford (UK)
Dr Simone Falco, Oriel College, University of Oxford (UK)
Dr Krzys Brzezinski, Oriel College, University of Oxford (UK)
Dr Jose Silva, MRC Cambridge Stem Cell Institute, University of Cambridge (UK)
Associate Prof. Luca Castagnoli, Oriel College, University of Oxford (UK)
Dr Amor Abdelkader, Department of Engineering, University of Cambridge (UK)
Dr Claudio Falco, Department of Engineering, University of Cambridge (UK)
Dr Alexandra Bocse, Trinity College, University of Cambridge (UK)
Dr Monique Boddington, Judge Business School, University of Cambridge (UK)
Andrew Fallow, Oriel College, University of Oxford (UK)

Evening Talk Topics (select 4 for each course)

- ✧ Victim Participation in International Criminal Justice: Extraordinary Chambers in the Courts of Cambodia
- ✧ The Global Recession of 2008/09 and Some Policy Responses
- ✧ Developments in Climate Change Negotiations: Can We Effectively Address Climate Change?
- ✧ The Fight against Terrorism: To What Extent Can States Use Force against Terrorists on the Territory of Other States?
- ✧ Mistakes and Accidents in Armed Conflict
- ✧ Artificial Intelligence: History, Myths and Reality
- ✧ Who Guards the Guards? The English Theatre and its Critics
- ✧ The Future of Entrepreneurship
- ✧ Winston Churchill: Greatest Briton?
- ✧ ASEAN: The Belt & Road Initiative
- ✧ The Ethics of Vaccination

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- ✧ Covid-19 and the Crisis of International Governance
- ✧ Human-Robot Relationships: The Future of Romantic Love?
- ✧ Life of an Oxford Student
- ✧ Life of a Cambridge Student
- ✧ Rowing in Oxford

Cultural Activity (select 4 for each course)

- ✧ Tour of Oriel College
- ✧ Academic Gowns
- ✧ Punting
- ✧ Croquet
- ✧ Ashmolean Museum
- ✧ Bodleian Library
- ✧ Museum of Zoology, Cambridge
- ✧ Tour of Somerville College
- ✧ Fine Dining at Oriel College
- ✧ Organ Concert
- ✧ Senior Library of Oriel College
- ✧ Student Vlog of Summer Institute

Programme Fee

For one course	GBP 990
For BIT students	GBP 880
For two courses	GBP 1, 980
For BIT students	GBP 1, 580
For four courses	GBP 3, 360
For BIT students	GBP 2, 960