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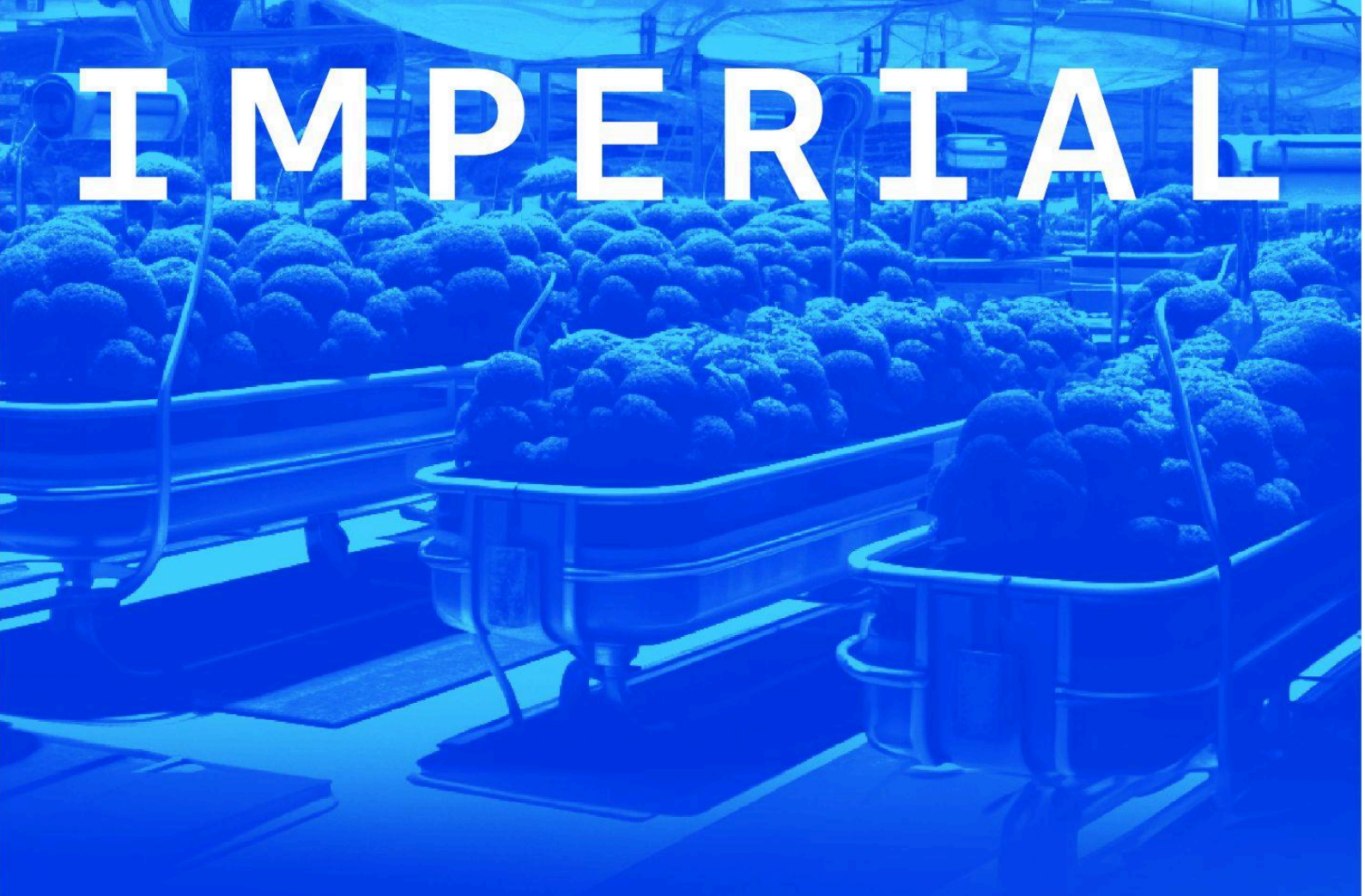


Dyson School of Design Engineering | Undaunted | Grantham Institute Climate Change and the Environment

MSc Cleantech Innovation

Student Guidance 2024 V1.1

Imperial College London

MSc Cleantech Innovation Programme Guidelines

Contents

Disclaimer: This document is a preliminary version and is subject to change!

Welcome and Overview of MSc Cleantech Innovation

Welcome from Academic Directors

Congratulations on being selected for the MSc Cleantech Innovation! We are excited to have you as part of the cohort.

This Masters course will bring together bright and passionate innovators, designers, scientists, engineers and entrepreneurs to find the science and technology-based sustainable solutions to address the global climate challenge – solutions that are needed urgently.

Throughout this course, you will meet and work with experts based at Imperial College London, startups, larger industry and other actors tackling climate change. You will work in teams throughout this programme which will allow you to forge deep relationships with your peers. We encourage you to be inquisitive, experimental and creative throughout your time with us. You will have coaches to guide you along your journey. In the following pages you will find further information on each module, expectations, and communication best practice. Please do take the time to read this information.

We look forward to working with you all through the year ahead and beyond.

The Program Directors

Aims, learning outcomes and key objectives

This unique programme will provide you with the skills of a Cleantech entrepreneur, enabling you to address the planet's most pressing environmental and climate challenges by leveraging Cleantech research for innovation. On successful completion of the programme, you will be able to:

Contextual evaluation & impact analysis	Collate, critically analyse and interpret relevant information that helps identify environmental and climate change challenges in a national and international context that can be tackled using engineering knowledge, skills and tools.
Cleantech Innovator's mindset	Synthesize expertise in cleantech research and design engineering through an innovation project and validate the technology by engaging with different stakeholders and academic experts.
Team working	Develop your ability to work in transdisciplinary teams to leverage different problem-solving approaches for difficult environmental challenges.
Professional identity	Reflect and evolve on professional identity in the context of being a cleantech innovator.
Prototyping	Build early prototypes through design engineering tools, iterate and optimise the technology through engaging the research community, and develop methods to allow transfer a cleantech technology from lab to applied context.
Cleantech Entrepreneur	Critically analyse the current state of the cleantech industry and its potential impact on society and the environment to explore the role of innovation and entrepreneurship in developing climate-resilient solutions.
Business Model Innovation	Develop novel approaches on how cleantech innovations can be introduced into organisations through the development, communication and deployment of business models, business plans, networking and negotiating skills.
Impact	Design strategies to calculate, measure, and monitor environmental and societal impact of cleantech innovation
Systems thinking	Apply systems thinking to extract the interrelatedness of social, economic, and environmental aspects of climate change.

Joint Program Delivery

MSc Cleantech Innovation is a cross-departmental, cross-institutional programme that brings together world-leading academics and experts from the world of design engineering, innovation, entrepreneurship and sustainability.

Dyson School of Design Engineering

Design Engineering is the fusion of design thinking, and engineering knowledge and practice within a culture of innovation and enterprise.

The Dyson School of Design Engineering is the 10th and newest engineering department at Imperial College London. It was founded in 2014 and assisted by a generous donation from the James Dyson Foundation. Our goal is to fuse together design thinking, engineering knowledge and practice, to foster a culture of innovation and enterprise, to help solve global problems with emphasis on sustainability, entrepreneurship and societal impact. The Dyson School of Design Engineering (DSDE) will be your home department throughout your time on this Masters.

Grantham Institute
Climate Change and the Environment
An institute of Imperial College London

The Grantham Institute – Climate Change and the Environment is Imperial College London's hub for climate change and the environment, and one of Imperial's seven Global Institutes established to promote interdisciplinary working and to meet some of the greatest challenges faced by society. We have a vision of a sustainable, resilient, zero-carbon future. To reach this vision we drive forward discovery, convert innovations into applications, train future leaders and communicate academic knowledge to businesses, industry and policymakers to help shape their decisions.

You will be taught by various Grantham Institute lecturers and staff, be part of the wider Grantham Institute network and have access to our resources.

Undaunted is the Grantham Institute's innovation activity Undaunted is nurturing a climate innovation ecosystem that enables the creation of scalable innovative solutions to the climate challenge at pace. We are working hard to make London and the UK a great place to start and scale intelligent innovative solutions. We envision a world with a healthy, global climate innovation ecosystem, where diverse innovators leading businesses of all sizes can deliver significant emissions reductions and climate resilience sustainably and at scale.

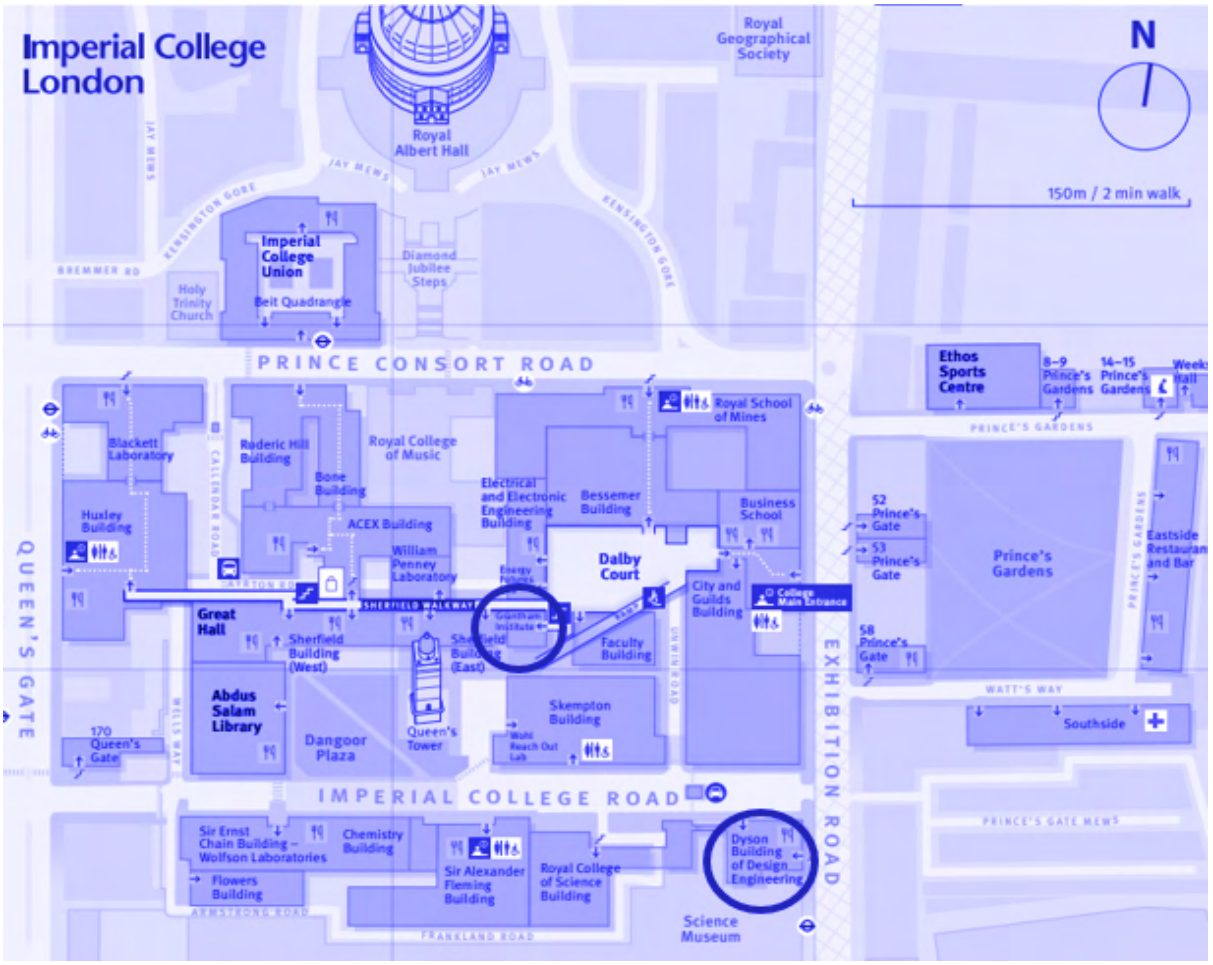
You will learn from Undaunted's specialist climate innovation staff and have access to the startups within Undaunted, who have been or are currently part of the Greenhouse Accelerator programme.

Locations

South Kensington

The majority of your teaching and workshops will be based on South Kensington campus, where both the Dyson School of Design Engineering and the Grantham Institute are based.

https://www.imperial.ac.uk/visit/campuses/south-kensington/



Map of South Kensington, showing Grantham Institute and Dyson School of Design Engineering

The DSDE has advanced fabrication tools, including 3D printers, CNC machines, and laser cutters, as well as a range of other specialist equipment for materials testing and analysis, specialist research laboratories, including a robotics lab, a wet lab, a teaching lab for craft and woodworking, a printer farm, and a material testing lab. The Grantham Institute will also provide space for seminars and workshops. Working with other researchers for their Cleantech Innovation Project (Part 1-3) across the Faculty of Engineering and the Faculty of Natural Sciences will be strongly encouraged and facilitated through Keynote lectures and lab tours. In addition to specialist lectures, students will also work with researchers on their group projects. (Affiliate Network and Cleantech Experts at Imperial College London)

The rooms that we plan to use most frequently are:

- Studio 3, Level Three, Dyson Building (Flat floor teaching space)
- The Design Library, Level One, Dyson Building (Flat floor teaching space)
- 1851 Lecture Theatre, Ground Floor, Dyson Building (Lecture Theatre / Flat floor teaching space)
- The Boardroom, Ground Floor, Dyson Building
- 409 Roderick Hill Lecture Theatre (Tiered Lecture Theatre for guest speakers)
- Digital Learning Hub, Royal College of Science Building (Flat floor teaching space)
- Lecture Theatre C, Royal College of Science Building (Tiered Lecture Theatre)
- GoStudy Space, Chemistry Building
- Grantham Institute Boardroom (flat floor teaching space)

We have a large studio study area on level 2 of the Dyson building. Also, most of our teaching spaces are flat floors where students can access when not in use for teaching. A café is located on the ground floor where students can use for ad hoc tutorials and meetings.

Satellite Locations / Partners: Accessing White City, Enterprise Lab & Silwood Campus

The Imperial Enterprise Lab offers a comprehensive array of services tailored to empower student innovators and entrepreneurs. These include co-working space to foster collaboration and networking, mentorship from seasoned professionals, workshops and events, support in securing funding and investment, and opportunities to participate in challenges and competitions to refine skills and gain experience.

The Enterprise Lab operates as an open and supportive environment. You can drop in to use the co-working space, attend events, or seek advice as needed at their space in South Kensington. The Enterprise Lab welcomes anyone with an entrepreneurial spirit, even if you're just exploring possibilities. You can come and learn, network, and get inspired to develop your own venture. Many people join to participate in the annual challenges, but you can also gain specific skills, or simply be part of the supportive community.

White City

Map can be found here https://www.imperial.ac.uk/visit/campuses/white-city

Undaunted is based at the White City campus, which is a platform for innovation, entrepreneurship and multidisciplinary research at Imperial College London. Facilities such as the Hackspace are also based at this campus. You will spend some time at White City to leverage off this ecosystem. You can visit the White City Campus with a virtual tour: https://imperialhackspace.com/3d-virtual-tour-of-white-city-campus/.

Imperial College White City Advanced Hackspace

Imperial College White City Advanced Hackspace (Wet Lab)

Silwood Park is located about 25 miles West of Central London, near the village of Sunninghill in Ascot, Berkshire. Situated in about 100ha of natural parkland, it has been part of Imperial College since 1947. Since the 1990s research interests have expanded to include evolution, biodiversity and conservation. The campus contains all the features one would expect of a leading centre for life sciences research as well as a few additional, unexpected attributes.

Teaching Team

Anne Houston, Director of Training, Grantham Institute, Greenhouse Residency

Dr Elena Dieckmann, Lecturer, Dyson School of Design Engineering, Cleantech Innovation Project 1 & 3

Dr Shayan Sharifi, Director of Education, Dyson School of Design Engineering, Cleantech Innovation Project 3

Dr Reshma Rao, Lecturer (RAeng Research Fellow), Department of Materials, Climate Change for Cleantech

Alyssa Gilbert, Director UNDAUNTED, Grantham Institute, Climate Change for Cleantech

Dr Kamyar Hazeri, Teaching Fellow, Dyson School of Design Engineering, Design Eng. Tools for Cleantech Entrepreneurs

Gbemi Oluleye, Lecturer, Centre for Environmental Policy & Grantham Institute, Climate Change for Cleantech

Jim Shaikh, Director of the Greenhouse, UNDAUNTED, Grantham Institute, Cleantech Innovation Project Part 2, Greenhouse Residency

Prof. Anna Korre, Professor of Environmental Engineering, Department of Earth Science & Engineering, LCA & Social Impact for Cleantech Innovations

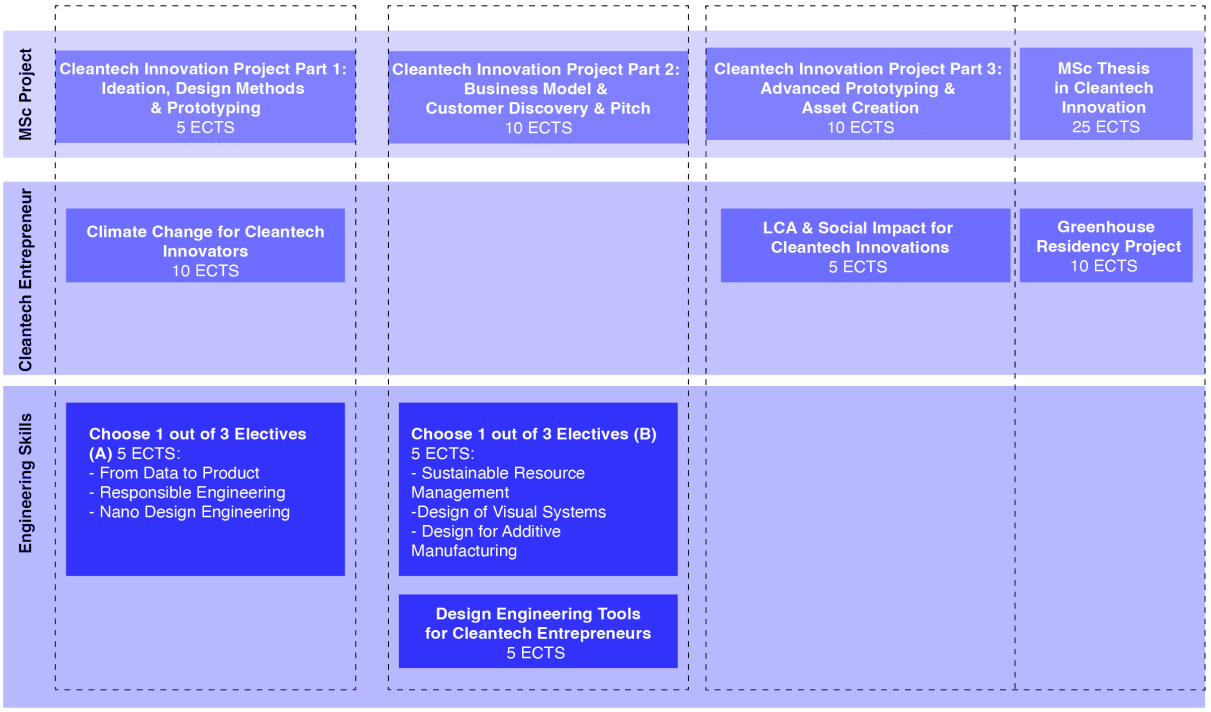
Enterprise Expert Tutor

Ben Mumby Croft,

Head of ICL Enterprise Lab

Overview of your course & credit breakdown

Your group project will be a central and unique element of the programme. The core modules are scheduled around, and integrated with, the team-building and project development sections, to ensure that the knowledge and skills you build can feed directly into your ideation, business model development and active innovation. For example, in the first term, you will have weekly deep dives into different areas of climate change challenges alternating with group project activities to build ideas from your new areas of knowledge.



The MSc in Cleantech Innovation, led by the Dyson School of Design Engineering and the Grantham Institute – Climate Change and the Environment, is designed to educate and train you to develop technological solutions to problems of unsustainability within specific contemporary climate challenge themes, which may include topics such as Agriculture & Food, Clean Energy & Storage, Transportation, Air & Environment, Circular Economy & Industry, Water, Efficiency. The programme is designed to equip you with the knowledge and skills to develop and implement innovation in at least one of the above mentioned cleantech areas.

The MSc in Cleantech Innovation aims to provide you with the skills of a cleantech entrepreneur, addressing the most pressing environmental and climate challenges our planet is facing through leveraging cleantech research for innovation across Imperial College London.

The MSc in Cleantech Innovation is offered over 12 months full-time. The programme content reflects the contemporary and relevant entrepreneurship skills necessary for developing cleantech innovation and launching a start-up. There is a balance of theory and

individual and group work to realize impactful cleantech innovation across seven impact areas [Clean Energy, Clean Industry, Clean Food, Clean Environment, Clean Water, Clean Materials, and Clean Transportation, see graphic below] taught by cleantech experts at Imperial. Case study methodology and class-based discussions are used to strengthen your conceptual, analytical, and problem-solving skills in real situations. In addition, there are regular seminars by external expert speakers from cleantech ventures.

The taught component of the programme is delivered over three academic terms. Over the summer period, you will complete a thesis on your Team Project and submit a self-reflection portfolio as part of a Greenhouse Residency Project (accelerator programme at Undaunted).

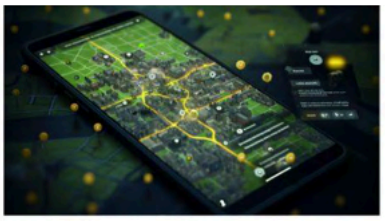
Over the first two terms, you will gain an understanding of the climate change challenges, environmental problems affecting different contexts, and foundational clean technology in the seven impact areas. You will learn progressively about the different stages of the entrepreneurship journey, including ideation & prototyping; business model; customer discovery; and pitching. Simultaneously, you will learn skills in design engineering, which will enable you to conclude your innovation project as part of the annual design showcase of the Dyson School of Design Engineering.

The MSc curriculum will be project-focused, where learning and teaching are done by way of practical innovation and entrepreneurship challenges set to small groups of students, who work individually and in teams in a self-directed, but supported, manner. The MSc in Cleantech Innovation offers intensive teamwork experience, like a typical early-stage start-up. You will be assigned to your team at the start of the programme and work with that team on the Cleantech Innovation Project over terms 1 to 3. Your core and compulsory modules, which are related to the Cleantech Innovation Project, plus the elective modules will run in parallel to your Cleantech Innovation Project. As the programme emphasises self-directed learning, there will be little “traditional” lecturing, rather the concepts and problems are presented in a way as to facilitate your self-directed learning. The programme directors and teaching fellows will be your coaches, and they will facilitate learning across technical aspects, both in team and individual efficacy dimensions, and will be present to support and guide you throughout the year, via tutorials, group sessions, and informal discussions.

The Cleantech Themes

Clean Materials

This theme will focus on environmentally friendly, sustainable, and recyclable materials, including biodegradable plastics, advanced composites, and innovative nanomaterials and low carbon processes to create those.

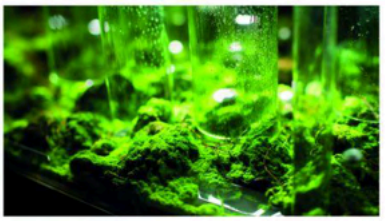


Clean Transport

This theme will look at themes like micromobility, multimodal transport, charging infrastructure and new fuel infrastructures for urban and rural environments.

Clean Industry

Innovation in this theme will emphasize eco-friendly manufacturing processes, renewable energy integration, and circular economy practices, leading the way toward sustainable, low-emission industrial operations that reduce environmental impact and promote resource efficiency.



Clean Water

Technologies will prioritize water purification and conservation strategies, such as advanced filtration systems, desalination innovations, and intelligent water management solutions, working together to ensure access to safe and sustainable water resources for all.

Clean Energy

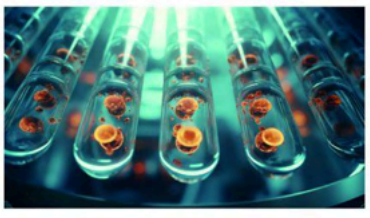
Technologies for solar, wind, hydrogen and advanced energy storage systems, driving the transition towards a sustainable and low-carbon energy landscape.

Clean Cities

In the future, clean cities will be transformed by innovative technologies, such as sustainable transportation systems, smart grids, and advanced waste management solutions, to create environmentally friendly and thriving cities.

Clean Food & Agritech

In the future transformative technologies, including precision agriculture, vertical farming, and sustainable food production methods, all contributing to a healthier and more environmentally responsible food supply chain, ensuring food security and minimizing ecological impact.



Clean Environment

This theme predominantly focuses on restorative and pollution reduction, such as air purification systems, ocean plastic cleanup technologies, and reforestation initiatives, all working synergistically to heal and protect our planet.

Module Outline and learning outcomes

Cleantech Innovation Project Part 1: Ideation, Design Methods & Prototyping

Module Lead: Elena Dieckmann

The first module will focus on the design thinking process, whereby you will develop ideas to address a climate change challenge. You will receive introductory lectures, materials and training on the design thinking method, whilst you undertake a module on climate change innovations in parallel, with specific sustainability challenge materials also being taught in the ideation module. The ideation relies in part on prototyping.

Learning outcomes

Upon successful completion of this module, you should be able to:
- develop innovative solutions to a defined challenge using the design thinking process and ideation tools
- demonstrate a range of potential solutions to the specific challenge, which you have scoped through teamwork and research
- collate, critically analyse and creatively interpret relevant information that helps identify climate change challenges in a national and international context that can be tackled using science, technology or engineering (STE) knowledge, skills and tools
- design and develop innovations to climate change challenges using appropriate STE knowledge, skills and tools
- work effectively as an individual and as part of a team

Assessment methods

Assessment type	Assessment description	Weighting	Pass mark
Coursework	10 Minute Group Presentation on project	25%	50%
Coursework	1 Page infographic on research	30%	50%
Practical	Prototypes	45%	50%

Cleantech Innovation Project Part 2: Business Model & Customer Discovery & Pitch

Module Lead: Jim Shaikh and Ben Mumby-Croft

In this module you will focus on customer discovery and modifying proposed solutions to match customer needs, as this is a critical step for the success of any cleantech start-up. Additionally, you will learn about financing options and how to pitch ideas to investors and stakeholders. Through exploring sustainability problems and meeting with cleantech entrepreneurs and industry experts, you will gain an understanding of research, development, and innovation in the cleantech sector. By developing business models linked to new sustainability problems, you will be equipped with practical skills and an innovative mindset to tackle cleantech challenges.

Learning outcomes

- Develop strategies to navigate uncertainty and ambiguity in the climate change innovation space while ensuring that the developed idea and business model meet customer needs.
- Introduce and diffuse entrepreneurial STE innovations into organizations and society through the development and deployment of business models, plans, and networking.
- Confidently pitch an innovation and identify financing options.
- Communicate effectively using a range of media directed to a variety of relevant stakeholders.
- Develop a strong business model and critically analyze and creatively interpret relevant information to identify climate change challenges in a national and international context that can be tackled using STE knowledge, skills, and tools.
- Analyze how entrepreneurial STE innovations can be introduced and diffused into organizations through the development and deployment of business models and plans.
- Develop, understand, and critically reflect upon personal and team development goals and plans.

Assessment method

Assessment type	Assessment description	Weighting	Pass mark
Practical	Team Presentation	40%	50%
Coursework	Output Report: 5-6 page Pitch Application	60%	50%

Cleantech Innovation Project Part 3: Advanced Prototyping & Asset Creation

Module Lead: Elena Dieckmann, Shayan Sharifi
This module will bring all the learning from the first two terms into practice. The module aims to provide you with the knowledge and skills necessary for advanced prototyping and asset creation in the cleantech industry. Through a combination of lectures, case studies, and hands-on activities, you will learn how to design, develop, and test advanced cleantech prototypes and assets, including hardware and software solutions. You will work in your team.

Learning outcomes

On completion of this module, you should be able to:
- Create and build advanced hardware prototypes to demonstrate a proof of concept for cleantech and climate adaption innovation
- Design and develop software solutions for cleantech applications.
- Use advanced scientific evaluation methods to test cleantech prototypes (digital and physical)
- Analyse the performance of cleantech solutions using relevant metrics and tools.
- Communicate the results of cleantech prototyping and asset creation effectively to stakeholders.

Assessment Method

Assessment type	Assessment description	Weighting	Pass mark
Coursework	Team Pitch Presentation and Q&A	50%	50%
Practical	Project Showcase	50%	50%

Climate Change for Cleantech Innovators

Module Leads: Alyssa Gilbert, Reshma Rao and Gbemi Olueye

This module will introduce you to the science behind climate change, potential solutions to climate change and key factors to consider in the implementation of these solutions.

Over the module, you will have an introduction to climate change and current solutions. This will be built upon as you learn about mitigation concepts and strategies, climate change impacts and adaptation whilst focusing on different challenge areas. Throughout the course, underlying factors will be woven in, including policy, governance, behavioural change and economics.

In the latter part of the module, you will choose a cleantech area to focus on, which you will then identify a research question for, design a research methodology and produce a short research proposal.

Learning outcomes

On completion of this module, you should be able to:
- Compare the different priority areas for reducing greenhouse gas emissions and evaluate the role that innovation can play in different sectors
- Collate, critically analyse and creatively interpret relevant information that helps identify climate change challenges in a national and international context that can be tackled using science, technology or engineering (STE) knowledge, skills and tools and particularly where innovation can be applied most impactfully
- Appraise the multidisciplinary nature of the climate crisis and apply opportunities for change across disciplines, including the application of social sciences to enable the more rapid, effective and fair uptake of solutions

- Appreciate the range of climate range impacts that have occurred and are anticipated, how climate innovation can help in the area of climate impacts and adaptation, and critically discuss the impacts and solutions applied or planned in different sectors
- Reflect critically on current solutions and innovations and the factors behind their success, or barriers to success
- Classify the importance of clean technology research in sustainable development
- Construct research questions and develop appropriate research methodologies for clean technology projects
- Effectively communicate research findings through oral and written presentations.

Assessments

Assessment type	Assessment description	Weighting	Pass mark
Practical	5 minute video presentation	60%	50%
Coursework	Written research proposal	40%	50%

Design Engineering Tools for Cleantech Entrepreneurs

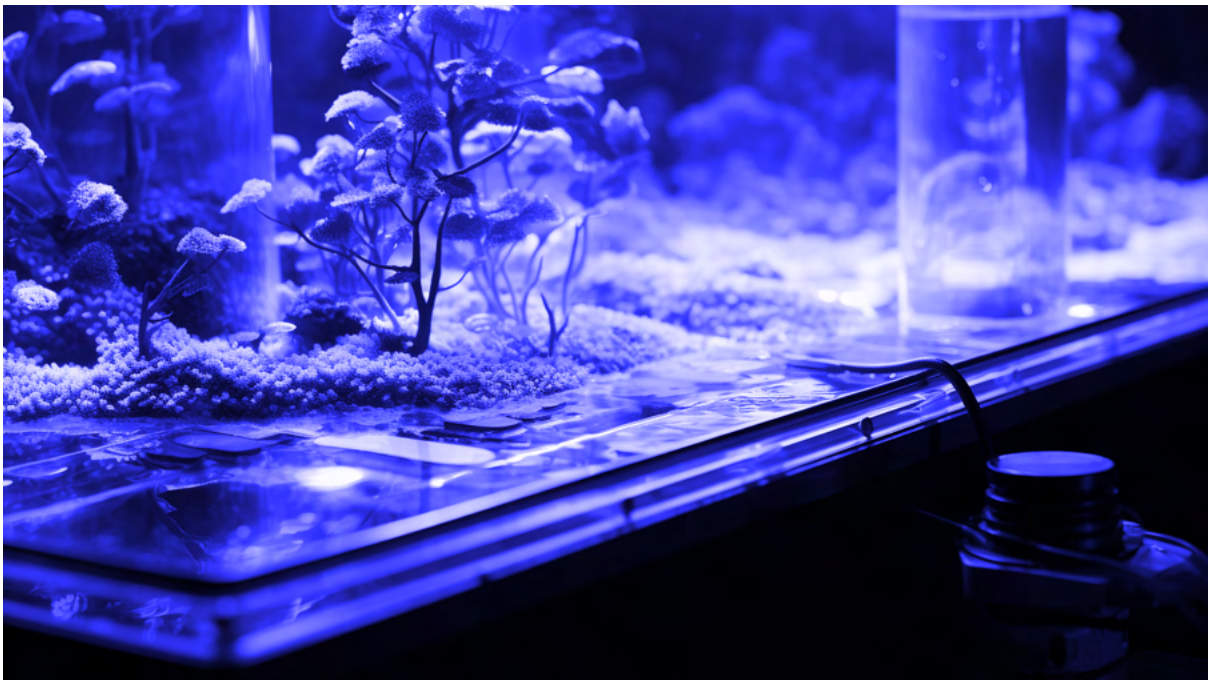
Module Lead: Kamyar Hazeri
Through a series of practical exercises and design challenges, you will develop your design thinking skills, as well as your ability to generate and communicate innovative design solutions. In this module, you will learn practical design skills using different software programs, with a specific focus on their application to cleantech entrepreneurship. The module will cover various design techniques, including 2D and 3D modelling, computer-aided design (CAD), simulation, and visualization. You will gain hands-on experience using popular software programs such as SolidWorks, AutoCAD, and Rhino, among others.

Learning outcomes

- Develop an understanding of the role of product design in cleantech innovation and its impact on sustainability
- Demonstrate proficiency in using various software programs commonly used in product design, such as Sketch, SolidWorks, and Autodesk Fusion 360
- Develop technical drawings and specifications that accurately communicate design intent to manufacturers and other stakeholders
- Collaborate effectively with cross-functional teams to incorporate engineering, marketing, and business considerations into product design decisions
- Critically analyze and iterate on product designs based on user feedback and testing results to improve functionality and sustainability
- Communicate design concepts and rationales effectively through visual and verbal presentations to stakeholders, including investors, customers, and regulatory bodies.

Assessment Methods

Assessment type	Assessment description	Weighting	Pass mark
Coursework	Module Portfolio	100%	50%



Life Cycle Assessment (LCA) and Social Impact for Cleantech Innovations

Module Lead: Anna Korre

This module will allow you to build more depth into their innovation project by learning more about the Life Cycle Assessment tool and Social Impacts.

You will focus on learning about the impacts of their potential innovations, how these should be measured and considerations to make when developing, marketing and rolling out a product.

Learning outcomes

- apply Life Cycle Assessment (LCA) to their innovations - differentiate between different LCA tools and approaches available, and be able to select and use a tool that is most appropriate for their circumstances
- critically discuss the role of LCA
- identify and quantify the different types of social impact and the importance of this within cleantech innovation and climate change solutions
- inform on ways in which social impact needs to be considered and assessed throughout the innovation process and beyond.

Assessment method

Assessment type	Assessment description	Weighting	Pass mark
Coursework	10-page LCA document linked to the innovation project	60%	50%
Practical	Group presentation	40%	50%

Greenhouse Residency Project

Module Lead: Kate Field, Anne Houston

Through Undaunted's network of climate change start-ups, you will work with a start-up for 8 weeks. This will allow you to put your skills into practice and gain insights into and critically assess SMEs.

Learning outcomes

- critically analyse the functionality of a start up
- put into practice their learned skills, such as business model development and successfully addressing customer needs
- deliver pitches with confidence and ease
- articulate the factors that are important in running a successful start up and have developed self-awareness about their own strengths and weaknesses in this regard

Assessment methods

Assessment type	Assessment description	Weighting	Pass mark
Coursework	Individual Analysis and Reflection Report - 5 pages	100%	50%

MSc Thesis in Cleantech Innovation

Module Lead: Alyssa Gilbert, Elena Dieckmann

The MSc Thesis Module in Cleantech Innovation is a culminating experience that provides you with the opportunity to integrate and apply the knowledge and skills you have gained throughout your MSc program by working on your Cleantech Innovation Project. You need to demonstrate the ability to conduct independent evaluation of existing research, critically analyze data generated through their Cleantech Innovation Project, and communicate your findings in a clear and compelling manner.

Learning outcomes
- Conduct research analysis in an area related to Cleantech Innovation

- Analyze and interpret research data from other research

- Integrate and apply knowledge and skills gained throughout the MSc program to a substantial innovation project

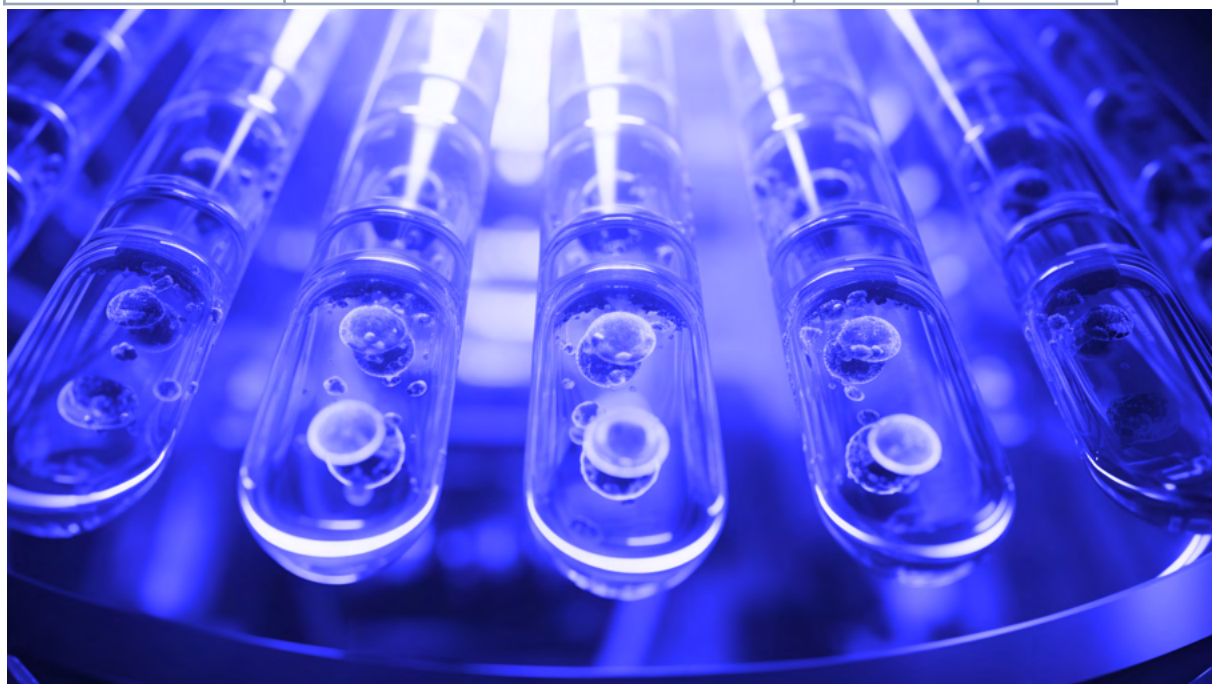
- Work closely with a supervisor who will provide guidance and support throughout the project

- Develop critical thinking and analysis skills to analyze and interpret research data, generated through prototypes or user testing

- Communicate findings in a clear and compelling manner

Assessment methods

Assessment type	Assessment description	Weighting	Pass mark
Coursework	MSc Thesis	80%	50%
Examination	Viva	20%	50%



Electives

Responsible Design Engineering and Design Innovation

As engineers, product managers and designers, we often make decisions that affect people's lives. These often raise ethical questions increasingly important to individual consumers, societies, governments and corporations, from behaviour change, to technology's bias and economic impact. This module aims to introduce you to critical ways

of thinking about technology products and their impact on individuals, their health and society as whole. The module explores design techniques for understanding stakeholders' values, and ethical and responsible innovation frameworks such as those being developed by the IEEE, the European Commission, and the UK Responsible Innovation Framework, and introduces concepts from philosophy of engineering and psychology. Students will learn how to explore questions about the impact their work will have on humanity, and apply it to design better products.

Data to Product

The module focuses on various aspects of data science in order design products from data. It first defines and introduces data products, as well as alternative ways to design with data. It looks at the varied ways to generate value from data, by going through relevant concepts within modern data science (e.g. descriptive, predictive and prescriptive analytics). Overall, the module provides you with the right skillset to go from ideas that involve data to outcome that bring added value to the user of that data.

Nano Design Engineering

This module will deliver a comprehensive introduction to Nanotechnology for Design Engineers. It will comprise of lectures and workshops that lead to the submission of a virtual project, where you will apply your new knowledge to design concepts. This course commences with an introduction to how the fundamental physical, electrical and optical properties of materials change on the nanoscale compared to their bulk counterparts. The methods used to fabricate nanomaterials will be discussed together with the Physics and Chemistry underpinning their extraordinary complexities, empowering you to tailor nanomaterial properties and to deduce design principles guiding nanotechnology applications. Building on these fundamental principles, will be a comprehensive overview of how different nanostructures and microdevices are driving the cutting edge of science and technology. The objective is to use these examples to expand the toolbox of techniques available to you and inspire you to use/adapt them for your virtual projects.

Sustainable resource management (Delivered by Civil and Environmental Eng)

In this module you will gain insight into sustainable resource management to conserve materials and energy, preserve natural resources and protect public health and the ecosystem. Specific topics will include: legislation and policy that drive change; circular economy to achieve resource efficiency; sustainable engineered solutions for material and energy conservation, and controlled emissions to the atmosphere; and tools to aid decision-making and evaluate impacts. The module focuses on important aspects in environmental engineering not covered elsewhere in the programme.

Design of Visual Systems

Modern engineering systems rely heavily on image and video data to inform decision making. Self-driving algorithms in vehicles and robots are just some examples. This module aims to provide overall knowledge and understand of the human visual system, and the technology available for design engineers to acquire, analyse, interpret and exploit visual

information gathered with modern electronic components. Apart from the usual lectures and tutorials, the module is accompanied by a series of practical exercises that help to teaching the course materials with real-life problems.

Design for Additive Manufacturing

It is vital that the next generation of engineers and designers are equipped with the knowledge and skills necessary to harness the full potential of Industry 4.0. Part of this new industrial revolution is Additive Manufacturing; an exciting and fast developing area of digital manufacturing.

This module provides engineering students with the platform needed to solve future industry challenges, get the most out of 3D printing technology and optimise designs. The module is aimed at engineering students who have an interest in 3D printing and advanced manufacturing methodology; who have the desire to become industry experts or academic researchers in this exciting area

Term Overview by Week

MSc in Cleantech Innovation		Individual	Cohort Events		Team Work	
Autum Term	30/09/2024 07/10/2024 14/10/2024 21/10/2024 28/10/2024 04/11/2024 11/11/2024 18/11/2024 25/11/2024 02/12/2024 09/12/2024	CORE A Cleantech Innovation Project Part 1: Ideation, Design Methods & Prototyping- (DSDE) -5 ECTS	CORE B Climate Change for Cleantech Innovators (Grantham) - 10 ECTS	Elective Responsible Design Engineering and Design Innovation- (DSDE) - 5 ECTS - LEVEL 7	Elective Nano Design Engineering (DSDE) - 5 ECTS - LEVEL 7	Elective Data to Product (DSDE) - 5 ECTS - LEVEL 7	20
X-Mas Break	16/12/2024 23/12/2024 30/12/2024						
Spring Term 2	06/01/2025 13/01/2025 20/01/2025 27/01/2025 03/02/2025 10/02/2025 17/02/2025 24/02/2025 03/03/2025 10/03/2025 17/03/2025	CORE A Cleantech Innovation Project Part 2: Business Model & Customer Discovery & Pitch - (Grantham) - 10 ECTS	CORE B Design Engineering Tools for Cleantech Entrepreneurs (DSDE) - 5 ECTS	Elective Sustainable resource management (CIVIL) - 5 ECTS - LEVEL 7	Elective Design of Visual Systems (DSDE) - 5 ECTS- LEVEL 7	Elective Design for Additive Manufacturing (DSDE) - 5 ECTS - LEVEL 7 (in 2024)	20
Easter Holiday/ College Closure	24/03/2025 31/03/2025 07/04/2025 14/04/2025 21/04/2025						
Summer Term 3	28/04/2025 05/05/2025 12/05/2025 19/05/2025 26/05/2025 02/06/2025 09/06/2025 16/06/2025 23/06/2025 30/06/2025	CORE A Cleantech Innovation Project Part 3: Advanced Prototyping & Asset Creation - (DSDE) - 10 ECTS Design Showcase	CORE B LCA and Social Impact for Cleantech Innovations (Grantham) - 5 ECTS				15
Summer Term	07/07/2025 14/07/2025 21/07/2025 28/07/2025 04/08/2025 11/08/2025 18/08/2025 25/08/2025 01/09/2025	MSc Thesis in Cleantech Innovation- 25 ECTS (Shared between DSDE and Grantham)	CORE B Greenhouse Residency Project - 10 ECTS (Grantham)				35

Assessment schedule overview

Tutorial Formats

PROGRESS REVIEW TUTORIALS

You have PRTs timetabled into the programme. This is a key source of tutor support and is compulsory. The main function of PRT is project management – i.e. keeping your projects on track. Those are work reviews so it is expected that you will attend with the work you have carried out in the recent days prior to the tutorials (so that could be research results, sketches, models, etc.) Presentation material is not required but turning up with a notebook and verbalising is not acceptable. Your PRT tutor will be in touch to arrange a time with you in bi-weekly intervals.

TUTORIALS WITH VISITING LECTURERS

You will be introduced to a number of researchers and world-leading experts. Let them help you narrow down your ideas or explore new areas. They have specific expertise and can give you practical advice on how to realise your ideas. We expect you to utilise the knowledge and keep a close eye on the weekly sign-up sheet to book project-critical tutorials. Make sure you sign up to at least 1 tutorial each week. Due to this deliberate diversity in the tutors and tutorials, you may often receive different (sometimes conflicting) viewpoints - it is up to you to decide how (and if!) these will direct and influence your work and practice. In addition to all of the above, you should be seeking advice wherever you need it both within and beyond the two institutions. Talk to each other, talk to us, and talk to people out in the real world… seek broad independent input.

TEAM DEVELOPMENT TUTORIALS

You are expected to attend group tutorials with Jan Casey (as listed in the sign-up sheets) to reflect and discuss how effectively you are working as a team including issues such as leadership, roles and responsibilities, communication, teamwork, professionalism, planning and execution.

CROSS-COHORT EVENTS & SPECIAL EVENTS

On Monday afternoons we will host a range of cross-cohort events, such as Alumni talks, Peer Reviews or Year Meetings. Check the calendar for information. On some days we will schedule guest speakers and special events.

PERSONAL TUTORIALS

You will also be assigned a personal tutor who will meet with you once per term. Personal Tutorials are intended to check in on your personal wellbeing such as experiences in the programme (struggles and successes) and aspirations and strategy for the long term.

TECHNICAL SERVICES

SOFTWARE DEVELOPMENT, AR + VR, ARDUINO:

Projects involving software development and digital prototyping can be conducted, AR and VR headsets can be loaned in limited quantities to students. A range of different electronic kits can be accessed and borrowed. All items must be returned as agreed, otherwise, your group will need to supply a replacement.
https://docs.google.com/spreadsheets/d/1jSB0x4GT-CIw9m7WO34pz659hICOkdtgICk42iuAP2M/edit#gid=0

IMPERIAL COLLEGE SERVICE POINT

Some projects may require that you design a poster to present your work. Posters can be printed at Service Point, the Imperial College's on-site contractor for bulk and professional printing. *Ensure you allow sufficient time for the turnaround of printing tasks.*
https://www.imperial.ac.uk/media/imperial-college/faculty-of-engineering/bioengineering/public/Directions-to-Service-Point-Print-room.pdf

IMPERIAL COLLEGE ACE WORKSHOP

The ACEX workshop is a state-of-the art prototyping facility. A small selection of equipment is listed here:

- FDM 3D-Printing (x10+) (single and multi-material)
- SLA 3D-Printing
- FDM Composites 3D Printing
- 2.5D Router

- 5 Axis Micro Mill (wood/plastics envisioned only)
- Large Laser Cutter
- Vinyl Cutter

All groups have a budget for material use in the ACE workshop but also to spend on other labs and work that needs outsourcing if it cannot be accomplished within ICL. Material can be purchased through Ingrid using this form. If you need further support- you can contact Ingrid: i.logan@imperial.ac.uk.
Materials, that can be purchased via Ingrid:https://drive.google.com/file/d/1-F0k0sFMzBwQAGzv5xzH1vhywfJ9HyoG/view
If you would like to get trained on specific machinery- please arrange this with Ingrid.

Other Spaces (Pictures below)

- IDEAS Lab Design Society
- IM08 Wetlab
- Basement Labs (Textiles, Additive Manufacturing, E-Workstation & Robotics)

HEALTH & SAFETY

Cleantech Innovators make things, test things and deal with potentially dangerous quantities, e.g. chemicals, power, energy, force, pressure, mass and velocity. You must comply with Imperial College policies, procedures and codes of practice and make sure that H&S measures are in place to control risks; ensure that your activities do not present unnecessary or uncontrolled risks to yourself or to others; attend appropriate induction and training; report any accidents, unsafe circumstances or work-related ill-health of which you become aware to the appropriate person; not interfere with any equipment provided for Health and Safety; inform your supervisor or the person in charge of the activity in cases where you are not confident that you are competent to carry out a work or leisure activity safely, rather than compromise your own safety or the safety of others. These processes are all about enabling you to conduct the exciting work that you want to do, without harming yourself or those around you. So dream big, work out what risks are involved, fill the forms and submit them. After you receive approval go do it! It does not matter if you conduct your experiments and work at home or at college. Please fill out the attached risk assessment form prior to starting experimentation at any location. You do not need to conduct a risk assessment for things / processes that are utilised for the intended purpose. (Example: I want to make a banana smoothie using a blender >> No risk assessment required, BUT: I want to use a blender to extract precious metals from waste electronics >> Risk Assessment required.) You will receive training in Week 1 on Risk Assessment.
If you conduct work at ACE or Imperial, which requires a risk assessment- you need to submit this form. You can only start work, once approved.

The College's Health and Safety Policy
The College Safety Department

SOFTWARE DEVELOPMENT, AR + VR, ARDUINO:
Projects involving software development and digital prototyping can be still conducted, AR and VR headsets can be loaned in limited quantities to students. All items must be returned as agreed, otherwise, your group will need to supply a replacement.
https://docs.google.com/spreadsheets/d/1jSB0x4GT-Clw9m7WO34pz659hlCOkdtglCk42iuAP2M/edit#gid=0. Imperial IT troubleshooting 24/7 Support: ASK ICT (link)

PRINTING AT IMPERIAL:
It is possible to print to the communal college printers from your School issued private laptop. You will need your College ID card to do this.
https://www.imperial.ac.uk/admin-services/ict/self-service/computers-printing/printing-photocopying-and-scanning/how-to-print/
Printing to communal College printers and using the photocopiers costs money. You can purchase printer credits to charge your card at the Central Library or online. Communal printers and photocopiers can be found on Level 2, Dyson Building and the Central Library.

CHEM-ENG STORES (VWR INTERNATIONAL)
https://www.imperial.ac.uk/chemical-engineering/research/research-facilities-and-services/ , to talk to the staff there, to work out exactly what you would like to purchase or visit the store's operator website (VWR) at this link. The store is located in the Chemistry building.
Ask Elena for permission - this is NOT a walk-in Store.

LIST OF EXTERNAL SUPPLIERS:
https://drive.google.com/file/d/1xvI6batrZgWDtZ4JA-qWLOwzDv_uOFdL/view?usp=sharing

The programme will include an induction / team building period to help establish the cohort and identify groups for the programme. Students will receive teamwork training as part of the Cleantech Innovation Project Part 1, and experience cohort building activities at the start of term, which will give students the necessary prerequisites to master team dynamics and develop a good teamworking routine across the year. This will be also supported by a team dynamic coach (external) who will offer bi-weekly team consultations.

Student representatives will be responsible for assisting with the organization of social and other relevant events, with support from the PGT administrative staff where appropriate. These are expected to take part at frequent intervals throughout the year. Where suitable, the cohort will engage in larger activities, such as socials, Shark Tank Pitching, cross-programme peer reviews, and Hackathons and demo days with other Dyson School Master's students, and opportunities will also be created for students to interact with those from other departments such as the Royal College of Arts (RCA), Centre for Environmental Policy (CEP), Imperial College Business School and Energy Futures Lab (EFL), such as via guest lectures.

The School has a bank of loan laptops that students can borrow on a short-term basis, including all the software packages they might require to fulfil the tasks given to them. The College and School have licences that the students can utilise on their own machines on-site, e.g., Adobe Creative Cloud. Students receive an initial IT training session and have

access to IT support throughout the year. The following software packages are currently available to the students for the duration of the programme:

- SolidWorks
- Fusion 360
- Matlab
- GIMP
- SPSS
- Jupyter Notebook (Python)
- Scribus
- CES Edupack
- Inkscape
- KeyShot
- Learning Catalytics
- Adobe Creative Cloud (All apps)
- MS Office

Students also have access to computer rooms in the Central Library. Online resources are provided via Microsoft Teams and Blackboard. LCA Software will be provided by the module team.

When joining the programme, the students must be inducted into our teaching workshop (ACE) located behind the Sherfield Building. This is open to any student at the Dyson School of Design Engineering. Before conducting the induction sessions run by the relevant technicians, all students must pass a safety test, where they must score 100%. Following that they will be enrolled in the induction sessions. The ACE workshop is the place where the students can manufacture and test items for their project work. The facilities include a 3D printing farm, assorted electronics equipment, woodworking, plastics, resins, and metalworking, such as lathes and CNCs. The workshop is supervised by Design Engineering technicians between the hours 09:00-17:00 Monday-Friday. All taught programme modules have their allocated budget that accounts for the consumables to be used in the teaching workshop by the students taking that module.

Working Policy (What are rules)

All students will have a personal tutor and have access to the Senior Tutor, module coordinators, and Student Wellbeing Advisor. Attendance at activities will be monitored, and lack of attendance or failure to engage in group or individual activities will be followed up with the student.

Where significant concerns arise, programme leads will arrange a meeting with the student to discuss programme progress. The purpose of such a meeting will be to determine the reasons for this lack of satisfactory programme progress and to develop and implement appropriate intervention strategies to assist the student in gaining the necessary competence in a time frame that enables completion of the programme. Teams will be

informed about the Team and Management Policy at the start of the year. In cases, where a team loses a team member, due to unforeseen circumstances (e.g. Extenuating Circumstances) the policy will ensure that students are not unduly affected by changes in the team-structure. The assessment may be adjusted in exceptional circumstances to accommodate the changes. Appropriate signposting to other support, such as the Student Wellbeing Advisor or Disability Advisory Service may be included. Evidence of this communication will be maintained on the student's file with their agreement including outcomes, actions, and agreements as a result of that meeting.

Jan Casey – Meet your Team Coach

As a design management consultant and coach, I work at board and senior management level across sectors including finance, government, health, design, entertainment, travel, property and non-profit-making organisations.

I help companies of all sizes to fulfil their potential by understanding their requirements, analysing the issues and managing the necessary changes. This three-tier process has proven effective across all areas of brand and business management, team building and individual coaching.

Alongside this, my continuing practice as a psychotherapist adds an insightful, empathic and analytical dimension to my work.
I seek to bring clarity to complex situations. It is an honour to have the opportunity to do this alongside knowledgeable and appreciative clients in a wide range of disciplines.