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Welcome to the College

Congratulations on joining Imperial College London, the only university in the UK to focus exclusively on science, medicine, engineering and business.

From Fleming’s discovery of Penicillin to Gabor’s invention of holography, Imperial has been changing the world for well over 100 years. You’re now part of this prestigious community of discovery and we hope you will take this opportunity to make your own unique contribution.

We’re committed to providing you with the very best academic resources to enrich your experience. We also provide a dedicated support network and a range of specialist support services to make sure you have access to the appropriate help, whether that’s further training in an academic skill like note taking or simply having someone to talk to.

You’ll have access to an innovative range of professional development courses within our Graduate School throughout your time here, as well as opportunities to meet students from across the College at academic and social events – see page 6 for more information.

We actively encourage you to seek out help when you need it and try to maintain a healthy work-life balance. Our choice of over 375 clubs, societies and projects is one of the largest of any UK university, making it easy to do something different with your downtime. You also have free access to gym (following a one-off orientation fee of £40 in 2017-18) and swimming facilities across our campuses.

As one of the best universities in the world, we are committed to inspiring the next generation of scientists, engineers, clinicians and business leaders by continuing to share the wonder of what we do through public engagement events. Postgraduate students, alongside our academics and undergraduate students, make a significant contribution to events such as our annual Imperial Festival and our term-time Imperial Fringe events – if you’re interested in getting involved then there will be opportunities for you to do so.
Our Principles

In 2012 the College and Imperial College Union agreed ‘Our Principles’ a series of commitments made between students and the College. The Principles are reviewed annually by the Quality Assurance and Enhancement Committee and changes recommended for Senate approval.

Imperial will provide through its staff:
• A world class education embedded in a research environment
• Advice, guidance and support
• The opportunity for students to contribute to the evaluation and development of programmes and services

Imperial will provide students with:
• Clear programme information and assessment criteria
• Clear and fair academic regulations, policies and procedures
• Details of full programme costs and financial support
• An appropriate and inclusive framework for study, learning and research

Imperial students should:
• Take responsibility for managing their own learning
• Engage with the College to review and enhance provision
• Respect, and contribute to, the Imperial community

The Imperial College Students' Union will:
• Support all students through the provision of independent academic and welfare assistance
• Encourage student participation in all aspects of the College
• Provide a range of clubs, societies, student-led projects and social activities throughout the year
• Represent the interests of students at local, national and international level
Professor Sue Gibson,
Director of the Graduate School

The Graduate School has several roles but our main functions are to provide a broad, effective and innovative range of professional skills development courses and to facilitate interdisciplinary interactions by providing opportunity for students to meet at academic and social events. Whether you wish to pursue a career in academia, industry or something else, professional skills development training will improve your personal impact and will help you to become a productive and successful researcher. Professional skills courses for Master’s students are called “Masterclasses” and they cover a range of themes, for example, presentation skills, academic writing and leadership skills (http://www.imperial.ac.uk/study/pg/graduate-school/professional-skills/masters/). All Masterclasses are free of charge to Imperial Master’s students and I would encourage you to take as many as you can to supplement your academic training. The Graduate School works closely with the Graduate Students’ Union (GSU) and is keen to respond to student needs so if there is an area of skills training, or an activity that you would like us to offer, but which is not currently provided, please do get in touch (graduate.school@imperial.ac.uk). The Graduate School also runs a number of exciting social events throughout the year which are an opportunity to broaden your knowledge as well as to meet other students and have fun. Particular highlights include the Ig Nobel Awards Tour Show, the Chemistry Show and the Master’s 360 competition. You should regularly check the Graduate School’s website and e-Newsletters to keep up to date with all the events and training courses available to you. Finally, I hope that you enjoy your studies here at Imperial, and I wish you well.

Dr Janet De Wilde,
Head of Postgraduate Professional Development

I would like to welcome you to the Graduate School programme for postgraduate professional development. Our team of tutors come from a wide variety of experiences and we understand just how important it is to develop professional skills whilst undertaking postgraduate studies and research. Not only will this development improve success during your time at Imperial College, but it will also prepare you for your future careers. We are continually working to develop the courses we offer and over this year you will see a range of new courses including face-to-face workshops, interactive webinars and online self-paced courses. I encourage you to explore and engage with the diverse range of opportunities on offer from graduate school and I wish you well in your studies.
The Graduate School

You automatically become a member of the Graduate School when you register as a postgraduate student at Imperial.

The Graduate School has been set up to support all postgraduate students at the College through:

- Training and development courses
- Networking activities, social and academic events to encourage cross-disciplinary interactions
- Forums to represent the views of postgraduate students throughout the College

'Masterclass' professional skills courses

You can see the full range of free professional skills courses for postgraduate students on the Graduate School website:

[www.imperial.ac.uk/study/pg/graduate-school/professional-skills/masters](http://www.imperial.ac.uk/study/pg/graduate-school/professional-skills/masters)

All courses can be booked online.

Contact us

📍 Level 3, Sherfield Building, South Kensington Campus
📞 020 7594 1383
✉️ graduate.school@imperial.ac.uk
🌐 [www.imperial.ac.uk/graduate-school](http://www.imperial.ac.uk/graduate-school)

Imperial Success Guide

The Imperial Success Guide is an online resource with advice and tips on the transition to Master’s level study. More than just a study guide, it is packed with advice created especially for Imperial Master's students, including information on support, health and well-being and ideas to help you make the most of London.

[www.imperial.ac.uk/success-guide](http://www.imperial.ac.uk/success-guide)
Welcome from the Graduate Students’ Union (GSU)

I am delighted to be able to welcome you to Imperial College and to introduce you to the Graduate Students’ Union (GSU). The GSU ultimately serves to represent you as a postgraduate student and to ensure you have the most fulfilling and enjoyable time possible at Imperial.

The GSU is a university-wide representative body for postgraduate students with a committee comprised of democratically elected postgraduate students. The GSU works to support students on welfare fronts, represent students on educational matters by working with you to voice your concerns to College/departments, whilst also hosting recreational events throughout the year.

Imperial College London is undoubtedly a world-class institution with unique strengths in both teaching and research. Having been an Imperial student for 5 years myself I can fully appreciate that the university is nothing more than the people that comprise it – you’re among some of the brightest minds in the world and Imperial welcomes your contributions and enthusiasm in every sense! I encourage you to make the most of being a valued member of the Imperial community.

I hope you have a fantastic time here at Imperial and manage to take advantage of the richness of opportunity that awaits you. If you have any questions at this stage, then please do get in touch.

Luke McCrone, GSU President 2017/18

✉️ gsu.president@imperial.ac.uk
🖥️ www.imperialgsu.com
1. Introduction to the Department

Welcome from the Head of Department

I trust you have had a great summer, whether you were gaining work experience or taking a well-earned rest, and I hope that you are now ready to study again with renewed vigour!

You will be working alongside some of the brightest and most motivated students from around the world, taught by an exceptional group of internationally-leading experts. A strength of our Department, and the College as a whole, is its national and cultural diversity (well over 50 nationalities are represented in our Department alone) and we don’t intend to allow Brexit, or any other outside influence, to change that.

London is a wonderful place to be a student. Please take full advantage of your once-in-a-lifetime opportunity and find a good balance between studying hard to fulfil your potential, and enjoying the company of your fellow students and life in London.

Good luck for the coming year!

Professor Nick Buenfeld

Welcome from the Environmental Engineering Course Director

I would like to extend a warm welcome to you all as you join the MSc Cluster programme in Environmental Engineering under the direction of the Environmental and Water Resources Engineering Section (EWRE) in the Department of Civil and Environmental Engineering at Imperial College London.

The courses within the Environmental Engineering cluster are vocational courses, central to which are the concepts of sustainability and delivery of engineered solutions to conserve resources and protect the environment and human health. The history of the programme has its origins in Public Health Engineering established as a postgraduate course in 1950. On joining the course, you will become part of a long tradition of alumni of several hundred graduates who have benefitted from the teaching and training delivered by the Section. EWRE is one of the largest and most active sections within the Department with an extensive and diverse portfolio of research, and one that plays a leading role in national and international research activities, providing advice and guidance to UK and overseas governments and international agencies.

The Environmental Engineering MSc course provides, for both engineers and scientists, a rigorous treatment of the fundamental principles and practices of assessing and protecting the environment and human health. The programme deals with major topics in the provision of environmental services such as water supply, wastewater treatment, municipal solid waste and hazardous waste management, and resource conservation and recovery as applied to both developed and developing countries. The multidisciplinary nature of Environmental Engineering is reflected in the staff involved in the course, whose backgrounds include chemistry, biology, statistics, geology, materials and medicine, as well as civil engineering.

Distinctive features of this programme include its broad coverage of problems and issues concerned with the supply of clean water, sustainable waste management and pollution control; clear focus on providing the underlying science and technology to develop and understand engineering solutions to these problems; and opportunities to carry out research
in key areas of environmental engineering as part of national and international research projects.

The MSc cluster programme is accredited by The Joint Board of Moderators (JBM), and the Subject Threads of Sustainability, Design, and Health & Safety are embedded in modules that make up the taught programme, the Study Tour, the individual and group design projects, and the individual research projects.

The course is structured in three parts. In the Autumn term you will acquire core knowledge in topics of fundamental importance in environmental engineering, whereas in the Spring term the course content is more applied and shows how your core knowledge can be used to address environmental engineering challenges and problems. At the end of the spring term there is a Study Tour, which is an enjoyable occasion in a more relaxed atmosphere when you visit industrial sites and facilities of particular relevance to the taught programmes. The emphasis in the Summer term is on examinations in the first two weeks of the term, followed by a four month individual research project when you will use the knowledge you have acquired in the taught programme to tackle a challenging research project in a specific area of interest under the direct supervision of a member of academic staff, and in many cases, supported by an industrial sponsor. Throughout the course there are many opportunities for you to work on your own as well as part of a team in group work; experiences which test your communication, leadership, and interpersonal skills, as well as your technical competence, time and project management skills.

Assessment of the taught Modules is one of three methods: written examination only, coursework only or a combination of written examination and coursework. There are two formal examination periods (i) at the start of the Spring term when modules taught in the Autumn term will be assessed, and (ii) at the start of the Summer term when modules taught in the Spring term will be assessed.

The diversity of backgrounds, nationalities and degree disciplines of your fellow students, all with a common goal, through this vocational programme – to add value to their first degree – will give you a unique enriching experience, and an opportunity to create lifelong friendships for the future.

I take this opportunity on behalf of the staff in EWRE to wish you all a stimulating, rewarding and enjoyable year at Imperial.

Professor Sue Grimes

Welcome from the Hydrology and Water Resources Course Director

Welcome to the Hydrology and Water Resources Management MSc in the Department of Civil and Environmental Engineering at Imperial College London. On joining the course, you become part of a long tradition of alumni who have benefited from the teaching of and training in hydrology and are now playing important roles in water resource management, environmental protection and hydrological research in the UK and throughout the rest of the world. The course was first established in 1955 as Engineering Hydrology and was the vision of our first course director, Professor Peter Wolf. Over the following years its reputation and scope increased and in the early nineties the course name was changed to Hydrology for Environmental Management, reflecting the increasing importance of hydrology on the behaviour of the natural environment. The current name dates from 2009 and emphasises the increasing importance of water, not only as a source for drinking, but its role in food
production, environmental sustainability and ecosystems services, in addition to the traditional concerns of flood protection and water supply.

The course is structured in three parts. The **Autumn term** focusses on core knowledge of hydrological processes, measurement and analysis, whereas the **Spring term** is more applied and shows how your core knowledge can be used to address water related challenges and problems. At the end of the Spring term, we run a short study tour where you will be able to visit field sites and other hydrology related research and industrial institutions. The **Summer term** comprises a 4-month research project. This allows you to use the knowledge you’ve acquired through the taught programme to explore and research a specific area of interest under the direct supervision of academic staff, and in many cases, supported by an industrial sponsor.

**Assessment of the taught Modules is one of three methods:** written examination only, coursework only or a combination of written examination and coursework. There are **two formal examination periods** (i) at the start of the **Spring term** when modules taught in the Autumn term will be assessed, and (ii) at the start of the **Summer term** when modules taught in the Spring term will be assessed.

Throughout the course there are many opportunities for you to work on your own as well as part of a team in group work; experiences which test your communication, leadership, interpersonal skills as well as your technical competence, time and project management skills. One of the key features of the course, and often a major highlight for those who have attended, is the diversity of backgrounds and nationalities of your fellow students. You will find yourself part of a group with a variety of first degrees in science and engineering, as well as coming from many parts of the world. This sharing of backgrounds and cultures will help enrich your experience on the course and can provide lifelong friendships.

So on behalf of our staff in the Environmental and Water Resources Engineering Section, I wish you a stimulating and productive year at Imperial and an enjoyable time in one of the great capital cities of the world.

*Dr Adrian Butler*
# Academic and administrative staff

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English language requirement

See the Admissions website for details:

[www.imperial.ac.uk/study/pg/apply/requirements/english](http://www.imperial.ac.uk/study/pg/apply/requirements/english)

Information on English language support available while you’re here can be found under section 11 Wellbeing and Advice.

Attendance and absence

You must inform your Cluster Administrator if you are absent from the College for more than three days during term. If the absence is due to illness you must produce a medical certificate after seven days. If you miss an examination through illness you must produce a medical certificate immediately.

Summer Term: Formal teaching may have finished for the year, but while you are working on your project and writing your dissertation, you are still subject to the attendance conditions of your degree, up to the expiry of your student registration at the end of September 2018. The exceptions to this are:

- Short breaks (approved by your supervisor and notified to your Cluster Administrator by email).
- Completion of all the academic requirements of your degree.
- Approved Study leave (e.g. Fieldwork) [specific form to be completed].

Recording of External Study Leave

For those of you spending periods of time abroad which form part of your research project (e.g. Fieldwork), such absences must be covered by the Postgraduate Taught (MSc): Recording of External Study Leave Form (see Appendix A). This form must be completed and submitted, via your Cluster Administrator, in advance of the requested absence. A record will be held in Starfish and you must register your return from Study Leave in person to your Cluster Administrator in order that your record may be updated for audit purposes.

The Registry will be informed of all student non-attendances, as the College is obliged to report the non-attendance of students on Tier 4 visas to the Home Office.

Read through Appendix A – Monitoring Attendance of Students, for information on the procedures in the Department of Civil and Environmental Engineering.
Key dates 2017-18

Term dates
Autumn term: 30 September – 15 December 2017
Spring term: 06 January – 23 March 2018
Summer term: 28 April – end of course

Closure dates
Christmas/New year: 23 December 2017 – 01 January 2018
Easter holiday: 29 March – 03 April 2018
Early May bank holiday: 07 May 2018
Spring bank holiday: 28 May 2018
Summer bank holiday: 27 August 2018

Programme dates
Written examinations: First week of spring term and first two weeks of summer term
Study tour: Last week of spring term
Major project: May-August 2018
Project hand-in: 31 August 2018
Poster display: 19 September 2018 (TBC)
Board of Examiners meeting: 20 September 2018 (TBC)
End of course: 30 September 2018

Key events
Postgraduate Awards Ceremonies: 01 May 2019 (TBC)
Imperial Festival and Alumni Festival: 28-29 April 2018
2. Programme information

Imperial Mobile app

Don’t forget to download the free Imperial Mobile app for access to College information and services, including College emails and a library catalogue search tool.

www.imperial.ac.uk/imperialmobile

Programme overview

The Environmental MSc programmes within the Civil & Environmental Engineering Department are offered as two streams (i) Environmental Engineering and (ii) Hydrology and Water Resources Management. Both sets of programmes are offered with a Business Management option and Sustainable Development option (suspended for entry 2017/18), which replaces 20% of the core programme with appropriate topics.

The aims of our extensive suite of MSc courses are to:

- Attract very able engineers, scientists and related professionals from around the world by offering in-depth courses that focus on particular specialist areas and develop and extend students’ knowledge, professional skills and research experience.
- Meet the expectations of industry and academia, preparing graduates for professional or research careers in the UK and overseas, developing curricula that evolve to match the subjects’ changing requirements.
- Advance understanding of the underlying engineering science and practical techniques that underpin civil and environmental engineering.
- Provide teaching and learning that is informed by research and practice at the forefront of academic or professional disciplines.
- Provide an opportunity for students to show originality in the application of knowledge, and an understanding of how the boundaries of that knowledge are advanced through research.
- Develop students’ ability to deal with complex issues both systematically and creatively, demonstrating originality in tackling and solving problems.
- Engender the qualities needed for employment in circumstances requiring sound judgement, personal responsibility and initiative, in complex and unpredictable professional environments.
- Meet the career needs of students seeking specialist employment in civil and environmental engineering, addressing the skills needs of their potential employers.
- Provide students with a solid technical basis in the key areas of the engineering profession through delivery of a coherent, coordinated and balanced degree programme, integrating core engineering science with practical application.
- Enable students to acquire a mature appreciation of the context in which engineering projects are developed within the industry.
- Develop our students’ excellence in oral and written communication, and poster presentations.
- Provide students with sufficient material to explore the subject, to carry out self-organised study, and to think about the issues and challenges of the material, in preparation for professional practice.
Programme structure

The full time programme is taken over 12 months, with a single entry point per year at the beginning of October.

Part time options are:

- Two days per week over two years.
- Term release (taken part time on a term-by-term basis, over two years):
  http://www.imperial.ac.uk/civil-engineering/prospective-students/postgraduate-taught-admissions/environmental-engineering-cluster/term-release/

Competency statements

http://www.imperial.ac.uk/media/imperial-college/faculty-of-engineering/civil/public/msc/Competency-Standards.pdf

Accreditation and professional membership

We would like to encourage you to become a Student or Graduate Member of the Professional Institutions in the field that you are studying in. The following professional bodies are relevant for the Master’s programmes that we are running at the Department of Civil and Environmental Engineering. For each of them, we define the most appropriate route for you to become a member:

The Chartered Institution of Water and Environmental Management (CIWEM)

Student membership is free.

http://www.ciwem.org/membership/

The Chartered Institution of Wastes Management (CIWM)

Student membership is free.

http://www.ciwm.co.uk/ciwm/membership/

Further details of our accreditation are to be found at:

http://www.imperial.ac.uk/civil-engineering/prospective-students/postgraduate-taught-admissions/

Programme delivery

Modules will be delivered through a series of lectures, although teaching methods will vary between individual modules. Other teaching methods employed may include tutorials, group discussions, group work, progress tests, computer laboratory sessions, practical work, and
others depending on the member of academic staff responsible. Some lectures will be delivered by visiting academics or industry professionals, where appropriate.

Submission of Coursework

Coursework submissions may be online or in paper copy, depending on the preference of the setter.

Coursework Cover Sheets

Coursework coversheets for group and individual work can be found in the General Office. Each one contains a plagiarism declaration on the front which must be signed. An example of the coursework cover sheets used for individual and group work can be found in Appendix E.

Submitting Coursework

MSc coursework will be set with a due date and time, and specific submission information will be made available to students.

Receiving Marked Coursework

Lecturers should return coursework within three weeks of it being handed in (four, if this period includes a College vacation). If there is a delay you should consult your MSc Cluster Administrator.

Returned Marked Coursework

You are required to submit all your marked coursework to your MSc Cluster Administrator, unless instructed otherwise, by the end of the academic session for inspection by the External Examiners.

Penalties for late submission

Submissions made within 24 hours after the deadline has passed will have the mark capped at 50%. Submissions made more than 24 hours after the deadline has passed will receive a mark of zero.

Development of professional skills

Professional skills development will be delivered throughout the curriculum in various forms, including teamwork, problem-solving, applying concepts to real-world situations, and formal presentations.

Module descriptors

A full list of all MSc Environmental Engineering Cluster module descriptors can be found on the following link:
Computer requirements

All incoming MSc students are required to have a laptop computer for their Environmental Engineering MSc cluster courses. As part of the MSc course, students will receive the latest versions of the following software: Matlab (Mathworks), ArcGIS (ESRI), MathType (Design Science), Microsoft Office. The minimum hardware requirements are defined by the ArcGIS (ESRI) – please follow the ArcGIS link:


We recommend that the operating system is Windows 10.

For students using an Apple Computer (Mac OS X), we recommend Mac OS X 10.12 (Sierra) or 10.11. In order to use ArcGIS you will either need to setup a dual boot by allowing Windows to run natively on the Mac (e.g. Boot Camp) or use a virtualisation software. Both of these are available for free for full time Imperial students.

PLEASE BRING YOUR LAPTOP to the ICT Induction on Wednesday morning 4 October 2017.

Employability statement

Planning for your future is an important aspect of postgraduate study. At Imperial you'll be well-supported by our Careers Service, who are on hand to help in a variety of ways.

http://www.imperial.ac.uk/careers

Imperial is one of the UK universities most targeted by graduate recruiters who also play an active role in our career development programme.

This provides access to hundreds of potential employers in a range of settings including industry sector forums, employer presentations, careers fairs, mock interviews and our one to one ‘recruiter-in-residence’ sessions.

A large number of employers also advertise their opportunities each year through JobsLive – our online careers platform, which Imperial students can access from the first day of term.

Work opportunities

The Department encourages you to take early advantage of the careers education, information and guidance available from the following sources:

- College Careers Advisory Service (Level 5, Sherfield Building), with which you can book careers appointments, quick interview sessions, skills workshops, mock interviews, and much more.

http://www.imperial.ac.uk/careers/

- The transferable skills training programme run by the Graduate School.
Careers presentations and careers fairs, which occur throughout the autumn and spring terms. Details are circulated to all students closer to the dates.

Details of jobs will be posted on the careers sections of the website. New posts are notified to us throughout the year, so check online regularly:

Additionally you can contact the Departmental Careers Advisor for further guidance and information:

Dr Peter Stafford
Room 321
020 7594 7916
p.stafford@imperial.ac.uk

Timetable
Your timetable will be delivered direct to your Imperial College Outlook calendar.

Projects
Below is a list of typical example projects from the Environmental Engineering MSc Cluster:

- Feasibility of biopolymer production in wastewater treatment compared to standard energy recovery practices from sewage sludge anaerobic digestion
- Potential contribution of the various materials used in tyre manufacture to global carbon dioxide emissions and sustainability: a literature review
- The role of rating curve uncertainty in real-time flood forecasting
- Organic contaminant transfer to the food chain from recycling water materials in agriculture
- Towards a more adaptive water distribution network in Barcelona
- Evaluating the sustainability of primary water collection systems in Egypt

Research dissertation
The aim of the Research Dissertation is to undertake a specific piece of independent research in the form of a critical review, a laboratory- or field-based experimental investigation, or a modelling/numerical analysis project.

Students will normally be required to work full-time on their Research Dissertation commencing in the summer term immediately following completion of the MSc examinations in the summer term through to the end of August.

The output from the research is in two forms:
• A Research Paper: which is limited to 12,000 words maximum (excluding references and appendices)
• A Poster presentation: which describes the project and the research findings in a visual and graphical manner.

**Supervision arrangements**

Research projects will differ in their area of focus, but their role is to challenge the student to complete an independent piece of research under the direct supervision of a member of academic staff and may involve supervision from external parties where fieldwork is involved. Staff will provide one-on-one support and students are encouraged to maintain good contact with their supervisor throughout the period of research. The extent and nature of supervision will vary from one member of staff to another, so should a student have any difficulty, during the course of research, interfacing with his/her supervisor s/he should advise the Course Administrator as soon as possible.

**Reading Lists**

The College has introduced a new interactive system, Reading Lists, for students to view their reading lists, and create their own virtual library collections. Each of your modules on Blackboard Learn will include a direct link to the core and supplementary recommended texts on Reading Lists. You can also view where in the Central Library your recommended texts are available, and how many copies are available, as well as commenting and collaborating with other students.

http://www.imperial.ac.uk/admin-services/library/learning-support/reading-lists/

**Programme specification**

Programme specifications will be located here:


**Transferring between courses**

Students wishing to transfer between courses should first contact the member of staff below, who will advise you as to whether or not this may be possible. Please note that for MSc students, transfers must be requested by the end of the first cycle of lectures, no later than the end of Week 2, and may be restricted for those students under Tier 4 Visa restrictions.

Judith Barritt
j.barritt@imperial.ac.uk
3. Assessment

The MSc degree assessment comprises two distinct elements, Element 1 (the taught Modules) and Element 2 (the Research Dissertation) – successful candidates must satisfy the Board of Examiners in both elements to be awarded the MSc.

The elements above also apply to students taking Business Management (or Sustainable Development), where this material will be integrated into the overall examination and assignment results.

Progression

Where a student is not attending or progressing to the satisfaction of the Course Director during the session, a note of warning may be sent to him/her, indicating that a failure to improve will result in a “six-week warning” being sent to them by the College Registry. This is equivalent to notice of withdrawal and may result in:

- (For Visa-dependent students) a report being sent to the UK-VI, and curtailment of the student Visa, and with this revoking the right to remain in the UK.
- (For sponsored students) a report being made to your sponsors.

Part-time students are permitted to progress to a subsequent year at the discretion of the Board of Examiners, subject to satisfactory performance.

Criteria for the award of the degree

Pass Marks: Element 1 – the pass mark for each Module is 50%; and Element 2 – the pass mark for the Research Dissertation is 50%

The degree to be awarded in one of the following classifications:

Award of a PASS degree
A candidate will normally be considered for the award of a Pass degree if they satisfy the following criteria:

- An aggregate mark of 50% for Element 1 (taught modules), with no mark below 40% in any module and 50% in Element 2

Award of a degree with MERIT
A candidate will normally be considered for the award of a degree with Merit if they satisfy the following criteria:

- An aggregate mark of 60% for Element 1 (taught modules), with no mark below 50% in any taught module, and no more than 4 marks in the range 50-59%, and 60% in Element 2 (the Research Dissertation)
- The MSc to be completed within the minimum registration period.

Award of a degree with DISTINCTION
A candidate will normally be considered for the award of a degree with Distinction if they satisfy the following criteria:
• An aggregate mark of 70% for Element 1 (taught modules), with no mark below 60% in any module, and no more than 4 marks in the range 60-69%, and 70% in Element 2 (the Research Dissertation)
• The MSc to be completed within the minimum registration period.

Students will be provided with feedback on performance in “Grade” format. This feedback is informal, interim and subject to ratification (approval) by the Board of Examiners of the MSc Cluster in Environmental Engineering.

Marks for exams taken in January will be returned in grade format within 6 weeks of the last examination
Marks for exams taken in May will be returned in grade format within 8 weeks of the last examination

As a guide, grades should be interpreted as follows:

<table>
<thead>
<tr>
<th>Mark</th>
<th>Grade</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>85+</td>
<td>A*</td>
<td>Outstanding - distinction standard</td>
</tr>
<tr>
<td>70-84</td>
<td>A</td>
<td>Distinction standard</td>
</tr>
<tr>
<td>60-69</td>
<td>B</td>
<td>Good</td>
</tr>
<tr>
<td>50-59</td>
<td>C</td>
<td>Adequate (Pass Level)</td>
</tr>
</tbody>
</table>

The following are subject to discussion by the Board of Examiners

<table>
<thead>
<tr>
<th>Mark</th>
<th>Grade</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>40-49</td>
<td>D</td>
<td>Unsatisfactory/borderline</td>
</tr>
<tr>
<td>30-39</td>
<td>E</td>
<td>Not satisfactory – may need to be retaken</td>
</tr>
<tr>
<td>0-29</td>
<td>F</td>
<td>Not satisfactory – may need to be retaken</td>
</tr>
</tbody>
</table>

Past examination papers

A sample examination paper for each examined module will be made available on the Blackboard Learn Virtual Learning Environment (VLE).

Instruction to Candidates for Examinations:

Students who are candidates for examinations are asked to note that all examinations are conducted in accordance with the College’s Academic Regulations, the Regulations for Programmes of Study and the Examination Regulations.

Instructions for exam candidates can be found here:


The College’s Academic and Examination Regulations:

http://www.imperial.ac.uk/about/governance/academic-governance/academic-policy/exams-and-assessment/
Mitigating Circumstances Policy and Procedures:


College Policy on Exams and Religious Obligations:

4. Examinations

Examination guidance and regulations

Materials Permitted in Examinations

- Pencil cases which must be clear plastic.
- College identity cards (i.e. swipe card) which must be displayed on your desk.
- Pens, erasers and other drawing instruments as required.

Unless specified or designated “Open Book”, no additional materials may be introduced into examinations by candidates. If, in the opinion of the Board of Examiners, such materials are required, they will be provided or notified to all candidates and the standard examination rubric amended to state that they will be provided or allowed. Calculators will be provided by the Department. We are currently using Casio FX85GTplus. Dictionaries are not permitted.

No food is permitted in an examination room unless prior permission has been given due to medical need. No drinks are permitted except for water in clear plastic bottles.

Conduct of Examinations

- Be prepared.
- Take with you only the items listed above.
- Arrive 15 minutes before the exam is scheduled to begin.
- When you enter the examination room, do so in SILENCE.
- Switch off your phones (and other electronic devices) and place them in your bag.
- Leave your bags in the area indicated by the Invigilator or Supervising Academic.
- Find the desk with the examination card which has your candidate number (or name) on it, then sit down at this desk.
- **DO NOT** turn over or open your examination paper until you are instructed to do so by the Invigilator. However you may start to fill in the front of your answer book giving:
  1. Candidate number (CID).
  2. Degree (Subject).
  3. Title of Paper.
  4. Date.
- You **MAY NOT SPEAK** to anyone other than the Invigilator. If you do need to speak to the Invigilator, raise your hand. Speak in a quiet voice so as not to disturb the other candidates.
- Write in black or blue ink. Candidates are not permitted to use red or green ink, or to use any writing implement that is capable of producing red or green marks on the script. You should not write in pencil.
- If unsure of the meaning of a word or question in the examination, write down your interpretation of that word or question, and continue.
- The use of correction fluids (e.g. Snopake® and Tippex®) is explicitly not permitted.
- Candidates should indicate incorrect work by drawing a single diagonal line through the work concerned.
• At the end of the examination, stop writing when instructed to do so by the Invigilator or Supervising Academic.
• Ensure that your answer book and all supplementary papers carry your College Identifier Number (which is also your candidate number), and that all graph paper and supplementary answer books are securely tied together inside the back cover of the main answer book.
• Remain seated and silent. There may be candidates with additional time.
• When all examination materials have been collected by the examination team and you have been told you may leave, please do so in silence, collecting your belongings on the way out. You may not remove any examination material from the room.

Exam Technique

• Read the rubric carefully BEFORE answering any questions.
• Take some time to read through the questions and make a sensible decision as to which questions to tackle.
• Ask yourself:
  o Which questions can I answer fully?
  o Out of the questions I cannot answer fully, which ones can I answer the majority of?
  o Am I fulfilling the exam rubric?
  o **Example:** How much time should you spend answering each question? If there are five questions to complete in three hours, that is approximately 35 minutes per question.
• If you make a mistake just put a line through your work.
5. Plagiarism

1. Introduction to Plagiarism

You are reminded that all work submitted as part of the requirements for any examination (including coursework) of Imperial College must be expressed in your own words and incorporate your own ideas and judgements.

Plagiarism, that is the presentation of another person’s work, thoughts or words as though they were your own, must be avoided, with particular care in coursework, essays and reports written in your own time. Note that you are encouraged to read and criticise the work of others as much as possible. You are expected to incorporate this in your thinking and in your coursework and assessments, but you must acknowledge and label your sources.

Direct quotations from the published or unpublished work of others, from the internet, or from any other source must always be clearly identified as such. A full reference to their source must be provided in the proper form and quotation marks used. Remember that a series of short quotations from several different sources, if not clearly identified as such, constitutes plagiarism just as much as a single unacknowledged long quotation from a single source. Equally, if you summarise another person’s ideas or judgements, figures, diagrams or software, you must refer to that person in your text, and include the work referred to in your reference list or bibliography. Staff are able to give advice about the appropriate use and correct acknowledgement of other sources in your own work.

The direct and unacknowledged repetition of your own work which has already been submitted for assessment can constitute self-plagiarism. Where group work is submitted, this should be presented in a way approved by your Department. You should therefore consult your tutor or course director if you are in any doubt about what is permissible. You should be aware that you have a collective responsibility for the integrity of group work submitted for assessment.

The use of the work of another student, past or present, constitutes plagiarism. Where work is used without the consent of that student, this will normally be regarded as a major offence of plagiarism.

Failure to observe these rules may result in an allegation of cheating. Cases of suspected plagiarism will be dealt with under the College’s Exams, Assessments and Regulations, & Plagiarism, Academic Integrity & Exam Offences, a full copy of which can be found at the following: [http://www.imperial.ac.uk/student-records-and-data/for-current-students/undergraduate-and-taught-postgraduate/exams-assessments-and-regulations/] and is likely to result in a penalty being taken against any student found guilty of plagiarism.

There have been in the past a few cases of plagiarism in this Department, where we operate a zero-tolerance policy, leading to penalties that range from voiding a coursework mark to expulsion from the course. In the majority of these cases, plagiarism was the result of poor practice and lack of awareness, so you are strongly advised to familiarise yourself with what constitutes plagiarism and to seek clarification if and when in doubt.
2. Ethics and Academic Integrity

There are at least two very good reasons why plagiarism should be allowed no place in the academic business of Imperial College, and why it must therefore be met by severe punishment whenever it is encountered.

At its most fundamental, plagiarism is seeking to deceive somebody – one’s teachers or examiners, for example – by presenting the ideas of another person as though the ideas were one’s own – whether with that person’s assistance, or by theft. Deception and intellectual theft are morally unacceptable in any well-ordered society. In a society of professionally licensed engineers, such conduct is even more reprehensible in that it undermines the ethical foundation on which professional practice is based.

There is also a question of academic integrity. Students who knowingly use plagiarism as a painless way of compiling the work needed for assessments, and teachers who knowingly allow students to do it, are both contributing to a blight that undermines the quality and integrity of the degree qualification.

Students under intense pressure to produce a design, a technical report, or a dissertation may feel tempted to resort to plagiarism. They must resist. The Imperial College degree is highly prized because it is respected far and wide as a true mark of achievement. To safeguard the integrity of its degrees, Imperial College staff must take action whenever plagiarism is suspected. As for students, they must expect that the penalty for a student who is guilty of this offence will normally be severe.

3. Definition of Plagiarism

Plagiarism is the presentation of another person’s thoughts, words, images or diagrams as though they were your own – for example when you copy someone else’s work or use their ideas in your coursework, thesis, report etc, and then do not acknowledge that you have done this.

Definition:

‘The wrongful appropriation or purloining, and publication as one’s own, of the ideas, or the expression of the idea (literary, artistic, musical, mechanical, etc.) of another.’


Other forms of plagiarism include self-plagiarism, which involves using your own prior work without acknowledging its reuse; and collusion, which involves sharing or copying (individual) coursework.

Plagiarism, whether intentional or unintentional, is considered a cheating offence and must be avoided, with particular care on coursework, essays, reports and projects written in your own time, and also in open and closed book written examinations.
Plagiarism is classified as either Minor or Major in nature, this is normally determined by the weight, or marks value, attached to the work submitted. However, the following would also be classified as major:

- Two cases of Minor plagiarism by the same individual
- Copying the work of another student without their knowledge
- Dissertation/Major Project
- Where the student does not admit that plagiarism has occurred, and that the plagiarism offence is upheld on appeal.

You are **not** permitted to act in collusion with another student or person, nor are you permitted to request or arrange for another individual to submit your coursework for you.

**You must NEVER:**

- Share your coursework, either electronically or in paper copy. If copying of material occurs as a result of such sharing, both parties are considered to have actively taken part in plagiarism.
- Give your coursework, whether electronically or in paper copy, to someone else to submit. If copying of material occurs as a result of such activity, both parties are considered to have actively taken part in plagiarism.

### 4. Collaboration (joint & group work) and Collusion

Students can struggle to understand the difference between collaboration and collusion.

**Collaboration:** Unlike collusion (where the work of another student is intentionally used with that student’s consent) which equates to deception, collaboration is encouraged as a professional skill much needed in engineering work. Collaboration involves mutual effort and joint work, to the benefit of all the parties involved, and where appropriate it should always be acknowledged, via footnotes for example. Students required to submit individual pieces must be clear on the distinction between the two.

Discussing coursework exercise submission with colleagues is fine: – what does the teacher expect from the work, what different approaches might there be, how much detail would be needed, how structured should the report be? In exploring with a colleague a range of approaches, or how to obtain specific solutions, one finds a positive help in learning something new. However, if the work is required to be an individual submission, then a line must be drawn where joint work is left behind and the individual work which is submitted for assessment should take over.

The results or calculations that form the basis of the report should be obtained by the individual student who is submitting the report as his/her own work, unless there is a clear expectation that others would be involved – as in the results of a survey – but then the contribution of the others should be made clear (for example, as footnotes in the report). The student is expected to write the report in his/her own words, to think of his/her own interpretations of the results and to make his/her own conclusions and recommendations.
Group work, for example group design projects, is work which is set by the teacher for joint working between two or more students and in which it is clearly understood that the teacher will give the assessment for the joint work undertaken. This provides valuable working experiences and learning opportunities, but these high-minded intentions can be severely undermined if any member of the group should not contribute in equal measure with his/her colleagues.

A student should **always** assume that coursework is individual work, unless it is clear that group assessment is planned by the teacher. If in doubt, seek the teacher’s advice about what working practices are acceptable. Do not hand over your work, under any circumstances, to another student

**Collusion:** Where the work of another student is used with that student’s consent.

5. Referencing

The recommended method of referencing is the Harvard style (author-date). All students have free access to **RefWorks**, an online reference management software package. More information is at the library website:


and library staff will provide training (contact details in section 6).

6. Advisory Services

**Academic Staff**

Your main source of information, and the College’s main source for the recognition of plagiarism, is the academic staff. Please be aware that you can approach them for advice and information if you are unsure or require clarification.

**The Library**

You can contact your librarian for advice, either in person or by emailing:

**Liaison Librarian:** Nicole Urquhart, n.urquhart@imperial.ac.uk

**Department Librarian:** Callum Munro c.munro@imperial.ac.uk

If you do have a query about a reference layout, include as much information as you have about the item you need help with.

The Central Library provides several sources of further information relating to referencing and plagiarism awareness:

- A guide to referencing and citing correctly, including how to use the Harvard style is available at [http://www.imperial.ac.uk/admin-services/library/learning-support/reference-management/](http://www.imperial.ac.uk/admin-services/library/learning-support/reference-management/)
• Further information about plagiarism awareness within College, please see the library website at [http://www.imperial.ac.uk/admin-services/library/learning-support/plagiarism-awareness/](http://www.imperial.ac.uk/admin-services/library/learning-support/plagiarism-awareness/).

• In addition you can access the Library’s online Blackboard course, “Ensuring Integrity 1: Plagiarism Awareness” for Master’s students, using your College username and password. The course is available at [http://bb.imperial.ac.uk](http://bb.imperial.ac.uk) and contains a section on plagiarism and how to avoid it.

**Turnitin-UK**

TurnitinUK is an online service hosted at [www.submit.ac.uk](http://www.submit.ac.uk) that enables institutions and staff to carry out electronic comparison of students' work against electronic sources including other students' work. Once papers have been submitted to the system they become part of the database, and will be used for future checking.

**IP / Data Protection**

Some people have asked whether departments need to seek permission from students before submitting their work to a plagiarism detection system. The answer is no as the registration form, which is signed by students, states the following:

The College may submit your coursework to an external plagiarism detection service. By registering with the College, you are giving your consent for any of your work to be submitted to such a service'.

**JISC Plagiarism Advice.org**

[www.plagiarismadvice.org/](http://www.plagiarismadvice.org/)

Emphasis is on academic good practice from the lecturer's perspective, but the service can also provide help to students.

**7. Submission of Individual Items of Coursework**

Copying the work of others without acknowledgement of the source of the information is academic fraud, known as plagiarism. Wilfully copying is outright cheating, forgetting to list references and reference material is ineptitude. Neither form of plagiarism is acceptable and may well result in one or more parties, deemed to be involved, being awarded a mark of zero.

All coursework, project work and research submissions, including dissertation must contain the following statement, signed by the student.
Declaration: I confirm that this submission is my own work. In it, I give references and citations whenever I refer to, describe or quote from the published, or unpublished, work of others.

Signature: _____________________

Failure to submit the signed declaration with all written works will result in their being unmarked, or returned with a mark of zero.

An exemplar of a Coursework Cover Sheet is given on the following page.

More information on the actions taken by the Department following cases of suspected plagiarism will be provided to you at the time that you are given your first coursework assignments.
6. Board of examiners

**Board of Examiners**

**CHAIR**

- Professor Stephen Smith

**EXAMINATIONS OFFICER**

- Professor Sue Grimes

**SECRETARY**

- Judith Barritt

**MEMBERS:** All staff involved in the delivery, setting, and marking of assessment for the programmes.

**For external examiners**

- Dr Sabeha Ouki, University of Surrey

Master’s level students will have the opportunity to meet the external examiner during the assessment process.

It is inappropriate for you to submit complaints or representations direct to external examiners or to seek to influence your external examiners. Inappropriate communication towards an examiner would make you liable for disciplinary action.

External examiner’s reports can be found here:

7. Location and facilities

Imperial has a number of campuses in London and the South East. All have excellent travel links and are easily accessible via public transport.

Your main location of study will be:

📍 Department of Civil and Environmental Engineering
Skempton Building
South Kensington Campus
Imperial College London
London SW7 2AZ

The Skempton building can be accessed from 07.00-00.00 daily. The main entrance requires the use of your college ID card between the hours of 07.00-08.00 and 18.00-00.00. During weekends and vacation periods you will be required to use your college ID card each time you enter and exit the building.

Smoke-Free Policy

All Imperial campuses and properties are smoke-free. This means that smoking by staff and students is not permitted on or within 20 metres of College land. The policy covers all College properties, including student accommodation and sports grounds.

🖥️ https://www.imperial.ac.uk/smoke-free

Facilities

PC laboratories

The Skempton Building houses three PC laboratories located in rooms 208, 314, and 317. These facilities are shared space with the Department of Aeronautics and the Department of Mechanical Engineering. They are open to all registered students of the aforementioned Departments from 08.00-22.30 daily, except when timetabled for classes. Further PC facilities are available in, and shared with, the City and Guilds Building, and the College’s Central Library.

A full list of the College rules regarding computer use are available at:

🖥️ http://www.imperial.ac.uk/admin-services/ict/

Shared teaching space

The Faculty of Engineering is committed to utilising its facilities and teaching space, hence there are a number of shared teaching spaces between Departments/Buildings. Teaching space in the Skempton Building is often timetabled to accommodate lectures between the Civil and Environmental, Mechanical, and Aeronautical Engineering Departments.
<table>
<thead>
<tr>
<th>Room</th>
<th>Level</th>
<th>Capacity</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meeting Room 002</td>
<td>0</td>
<td>20</td>
<td>Seminars – presentations</td>
</tr>
<tr>
<td>Teaching Room 060A</td>
<td>0</td>
<td>30</td>
<td>Lectures – tutorials – examinations – presentations</td>
</tr>
<tr>
<td>Teaching Room 060B</td>
<td>0</td>
<td>30</td>
<td>Lectures – tutorials – examinations – presentations</td>
</tr>
<tr>
<td>Teaching Room 060C</td>
<td>0</td>
<td>36</td>
<td>Lectures – tutorials – examinations – presentations</td>
</tr>
<tr>
<td>Learning Centre 062</td>
<td>0</td>
<td>24</td>
<td>Exams – tutorials – study groups</td>
</tr>
<tr>
<td>Teaching Room 064A</td>
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<td>Lectures – tutorials – exams – presentations</td>
</tr>
<tr>
<td>Teaching Room 064B</td>
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<td>27</td>
<td>Lectures – tutorials – exams – presentations</td>
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<td>Laboratory Room 043</td>
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<tr>
<td>Teaching Room 163</td>
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<td>Lectures – tutorials – exams – presentations</td>
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<tr>
<td>Lecture Theatre 164</td>
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<td>160</td>
<td>Lectures – presentations – seminars</td>
</tr>
<tr>
<td>Teaching Room 165</td>
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<td>Lectures – tutorials – exams – presentations</td>
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<td>Laboratory Room 158</td>
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<td>Structures Laboratory</td>
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<td>122</td>
<td>Lectures – presentations – seminars</td>
</tr>
<tr>
<td>Lecture Theatre 207</td>
<td>2</td>
<td>50</td>
<td>Lectures – presentations – seminars</td>
</tr>
<tr>
<td>Munro Computing Lab 208</td>
<td>2</td>
<td>70</td>
<td>Computing – lectures – tutorials</td>
</tr>
<tr>
<td>Reprographics Room 218</td>
<td>2</td>
<td>N/A</td>
<td>Printing and binding facilities</td>
</tr>
<tr>
<td>Laboratory Room 221</td>
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<td>N/A</td>
<td>Intelligent Infrastructure Transport Systems (IITS) Laboratory</td>
</tr>
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<td>Teaching Room 224</td>
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<td>60</td>
<td>Lectures – tutorials – presentations – seminars – practicals</td>
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<td>Mezzanine Lab 240</td>
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<td>Workshops – lab practicals – design classes</td>
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<td>Laboratory Room 509</td>
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<td>Environmental Laboratory (Roger Perry)</td>
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<td>Laboratory Room 528</td>
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<td>Geotechnics Laboratory</td>
</tr>
<tr>
<td>Teaching Room 601</td>
<td>6</td>
<td>40</td>
<td>Lectures – tutorials – meetings – exams – presentations</td>
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</tbody>
</table>
While the Department of Civil and Environmental Engineering is housed in the Skempton Building, teaching may also be delivered outside of Skempton, primarily in the City and Guilds Building.

Within the Skempton Building, the teaching areas are to be found on levels 0, 1, 2, 3, and 6, with the exception of the teaching laboratories which are located on levels 0, 1, 2, and 5. [http://www.imperial.ac.uk/engineering/students/current/teaching-spaces/](http://www.imperial.ac.uk/engineering/students/current/teaching-spaces/)

**College ID cards**

For MSc students who have uploaded their photos and registered online, ID cards can be collected from the General Office, Skempton Building following confirmed attendance at the day 2 Health and Safety induction. For those who have their photos taken on arrival, the ID card is normally available from the General Office in the Skempton Building within two days.

**ICT resources**

Find information on activating your College account, connecting to Wifi, using the Virtual Learning Environment (Blackboard Learn), and more ICT resources available for new students, visit: [http://www.imperial.ac.uk/admin-services/ict/new-to-imperial/students/](http://www.imperial.ac.uk/admin-services/ict/new-to-imperial/students/)

**Printing and binding**

There are five multi-function printers in the Skempton Building. The first is in room 317, two are located in the BOSS Space on level 2, and a further two in room 218 adjacent the BOSS Space. Binding facilities are also accessible in room 218. 

Additionally the Service Point Print Shop is located in room 024 of the Sherfield Building. Service Point can be contacted by email at: imperial.college@servicepointuk.com

There are networked printers across the South Kensington Campus, which you can access with your College ID card. When you print a document it is sent to a common print queue, meaning that you can collect it from any touch card printer that your College ID card gives you access to, including the Central Library and Departments across the Campus. [http://www.imperial.ac.uk/admin-services/ict/self-service/computers-printing/printing/](http://www.imperial.ac.uk/admin-services/ict/self-service/computers-printing/printing/)

**Lockers**

There are 312 lockers located on Level 3, Skempton, of which 156 have been allocated to MSc students. If you would like to be allocated a locker you need to complete the relevant form below. Lockers can only be allocated to full time students. Numbers are limited and allocated on receipt of the form: [https://skempton.wufoo.eu/forms/z1f2aqyq1vg2fj2/](https://skempton.wufoo.eu/forms/z1f2aqyq1vg2fj2/)

The Department’s Postgraduate/General Office is located in room 118 in the ground floor of the Skempton Building, open Monday-Friday 08.00-17.30.

**Lost property**

If you think you have lost something within the Department your first port of call is the Reception. If it is not there you should check with the Security Office in Sherfield as it may
have been handed in there. (If an item is handed in with ID, an email will be sent to the owner immediately to inform them).

All items found within the Department (e.g. keys/phones/bags) should be handed into the Reception. All items found outside the Department should be handed into the Security Office in the Sherfield Building in the South Kensington campus. [http://www.imperial.ac.uk/estates-facilities/security/lost-and-found-property/](http://www.imperial.ac.uk/estates-facilities/security/lost-and-found-property/)

**Facilities management**

Showering facilities are available within the Department, and are located in the toilets on levels 0 and 3.

Bicycles are **not** permitted within the Department. This is College policy. The following link provides information on suitable bicycle storage within the South Kensington Campus: [http://www3.imperial.ac.uk/estatesfacilities](http://www3.imperial.ac.uk/estatesfacilities)

**Room bookings**

Room bookings on weekdays during term-time may be requested via an online form, or in person at the Postgraduate/General Office. This form is to be used only for room booking requests in the Skempton Building. [https://skempton.wufoo.eu/forms/ksiogd90gibuje/](https://skempton.wufoo.eu/forms/ksiogd90gibuje/)

Please note: **We do not make room bookings for Imperial College Union Societies.** These need to be made via the Student Union.

Room booking requests outside of normal College hours should be made via the Conference Office: [conferenceandevents@imperial.ac.uk](mailto:conferenceandevents@imperial.ac.uk)

**Shuttle bus**

A free shuttle bus runs between our South Kensington, White City and Hammersmith Campuses on weekdays. Seats are available on a first-come, first-served basis. You need to show your College ID card to board. Download the timetable at: [www.imperial.ac.uk/estates-facilities/travel/shuttle-bus](http://www.imperial.ac.uk/estates-facilities/travel/shuttle-bus)

**Maps**

Campus maps and travel directions are available at:

[www.imperial.ac.uk/visit/campuses](http://www.imperial.ac.uk/visit/campuses)

**Accessibility**

Information about the accessibility of our South Kensington Campus is available online through the DisabledGo access guides: [www.disabledgo.com/organisations/imperial-college-london-2](http://www.disabledgo.com/organisations/imperial-college-london-2)
8. Working while studying

If you are studying full time, the College recommends that you do not work part-time during term time. If this is unavoidable we advise you to work no more than 10–15 hours per week, which must be principally at weekends and not within normal College working hours.

Working in excess of these hours could impact adversely on your studies or health.

If you are here on a Tier 4 visa you are not permitted to work more than 20 hours a week during term time. Some sponsors may not permit you to take up work outside your studies and others may specify a limit.

If you are considering part-time work during term time you are strongly advised to discuss this issue with your supervisor/cluster administrator/course director. If you are on a Tier 4 visa you should also seek advice from the International Student Support team regarding visa limitations on employment.

Please refer to our policy on working while studying:

https://www.imperial.ac.uk/study/international-students/visas-and-immigration/work-rules-during-your-studies/
9. Health and safety

You are responsible for looking after your own health and safety and that of others affected by your College-related work and leisure activities. You must:

- Comply with all local and College policies, procedures and codes of practice and with the arrangements which the College has in place to control health and safety 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.

The College’s Health and Safety Policy can be found at:


Your Departmental safety officer is:

Dr Geoff Fowler
Room 413, Skempton Building
020 7594 5973
g.fowler@imperial.ac.uk

You are required to complete inductions and attend training sessions to safely complete this course. These include:

- Health and Safety induction, at which a checklist must be completed, signed by the student, and a relevant member of staff (Note: ID cards, available from the Postgraduate/General Office will only be given to those presenting the completed and signed Health and Safety checklist).

A copy of the Department Health and Safety Booklet can be found in Appendix F.

The College Safety Department

The Safety Department offers a range of specialist advice on all aspects of safety. This includes anything which you feel might affect you directly, or which may be associated with teaching, research or support service activities.
The College’s activities range from the use of hazardous materials (biological, chemical and radiological substances) to field work, heavy or awkward lifting, driving, and working alone or late.

All College activities are covered by general health and safety regulations, but higher risk activities will have additional requirements.

The Safety Department helps departments and individuals ensure effective safety management systems are in place throughout the College to comply with specific legal requirements.

Sometimes the management systems fail, and an accident or a near-miss incident arises; it is important that we learn lessons from such situations to prevent recurrence and the Safety Department can support such investigations. All accidents and incidents should be reported online at:

www.imperial.ac.uk/safety

To report concerns or to ask for advice you should contact your programme director, academic supervisor or departmental safety officer in the first instance. You may also contact the Safety Department directly.

**Occupational Health requirements**

The College Occupational Health Service provides services to:

- protect health at work
- assess and advise on fitness for work
- ensure that health issues are effectively managed

The Service promotes and supports a culture where the physical and psychological health of staff, students and others involved in the College is respected, protected and improved whilst at work.

www.imperial.ac.uk/occupational-health

**Communications**

It is not possible to provide a service for incoming telephone messages except in the case of emergency. Please ensure that your family/next of kin are aware of the following contacts:

Civil Engineering General (Postgraduate) Office

- 00 44 (0) 207 594 5929 (Fionnuala Donovan)
- 00 44 (0) 207 594 5932 (Yamini Chikhlia)
- 00 44 (0) 207 594 5931 (Melanie Hargreaves)
Please ensure that your student-e-service contact details are up-to-date at all times, including your next-of-kin-contact information.

The Department is not able to provide a postal or fax service.

**Working alone and emergency contact numbers**

It is prohibited under College safety regulations for any person to work alone in a laboratory or workshop at any time. At least one other person must be within calling distance. All members of the College must know how to contact emergency services.

Please save the following number in your mobile/cell phone for use in all emergencies anywhere on the College’s South Kensington campus – including where an ambulance is felt to be needed, the call will go direct to the College Security Control Desk: **020-7589-1000**

If using an internal College phone, the number to call is **4444**.

Any activity involving tools or machinery is deemed to be "working in a laboratory or workshop"; purely office or computing activities are excluded.

*(Full details are given at the front of the orange Safety Booklet – see student handbook)*.
10. College policies and procedures

Regulations for students

All registered students of the College are subject to the Regulations for Students, the College Academic and Examination Regulations and such other regulations that the College may approve from time to time.

www.imperial.ac.uk/about/governance/academic-governance/regulations
www.imperial.ac.uk/students/terms-and-conditions

Appeal and complaints procedures

We have rigorous regulations in place to ensure assessments are conducted with fairness and consistency. In the event that you believe that you have grounds for complaint about academic or administrative services, or wish to appeal the outcome of an assessment or final degree, we have laid out clear and consistent procedures through which complaints and appeals can be investigated and considered:

www.imperial.ac.uk/about/governance/academic-governance/academic-policy/complaints-appeals-and-discipline

Academic integrity

You are expected to conduct all aspects of your academic life in a professional manner. A full explanation of academic integrity, including information on the College’s approach to plagiarism is available on the Student Records and Data website:

http://www.imperial.ac.uk/media/imperial-college/administration-and-support-services/registry/academic-governance/public/academic-policy/academic-feedback/Academic-feedback-policy-for-taught-programmes.pdf

Intellectual property rights policy

For further guidance on the College’s Intellectual Property Rights Policy, please contact the Research Office:

www.imperial.ac.uk/research-and-innovation/research-office/ip

Use of IT facilities

View the Conditions of Use of IT Facilities:

http://www.imperial.ac.uk/admin-services/ict/self-service/computers-printing/staff-computers/conditions-of-use-for-it-facilities/
11. Well-being and advice

**Student Space**
The Student Space website is the central point for information on health and well-being.

[www.imperial.ac.uk/student-space](http://www.imperial.ac.uk/student-space)

**Director of Student Support**
The Director of Student Support has overall responsibility for all matters relating to student support and well-being.

[www.imperial.ac.uk/people/d.wright](http://www.imperial.ac.uk/people/d.wright)

**Departmental support and College tutors**
Your Department has a system of academic and pastoral care in place to make sure you have access to the appropriate support throughout your time here. This includes:

**Postgraduate Tutor**
In the event of an issue arising, within the Department there are a number of avenues for you to seek support. This will include your departmental Postgraduate Tutor, and other designated staff such as programme directors and senior administrative staff.

**Faculty Senior Tutor**
There are a number of avenues within the College to seek help with academic or pastoral matters: [http://www.imperial.ac.uk/student-space/](http://www.imperial.ac.uk/student-space/). In the event that you would like to seek additional support or guidance, or that you wish to air your issues in confidence, the Faculty Senior Tutor, Dr Lorraine Craig, can be contacted by email lcraig@imperial.ac.uk in the first instance. Depending on the nature of your query, it may be passed onto other more relevant staff.

**Advice services**
The tutor system is complemented by a College-wide network of advice and support. This includes a number of specialist services.

**Careers Service**
The Careers Service has strong links to your Department and you will have a named Careers Consultant and Placement and Internship Adviser who will run both group sessions and individual meetings within your Department. You can arrange to meet with your linked Careers Consultant or Placement and Internship Adviser either in your Department or centrally on Level 5 Sherfield where the Careers Service is based.

Visit the Career Service's website to:
- Book a careers appointment
- Find resources and advice on successful career planning

www.imperial.ac.uk/careers

Counselling and Mental Health

The Student Counselling and Mental Health Advice Service offers short-term counselling to all registered students. The service is free and confidential. Counsellors are available at the South Kensington, Hammersmith and Silwood Park Campuses.

www.imperial.ac.uk/counselling

Financial support and tuition fees

If you’ve got any questions about student financial support (loans, scholarships and research council studentships, US and Canadian loans) then contact the Student Financial Support team:

020 7594 9014
student.funding@imperial.ac.uk

If you suddenly find yourself in financial difficulties or experience an unexpected change in circumstances, you may be eligible to apply for emergency financial help through the Student Support Fund. The Fund offers a one-off payment of up to £2,000 to cover such emergencies as last minute accommodation and travel necessities, equipment and childcare. It does not have to be repaid.

http://www.imperial.ac.uk/students/fees-and-funding/financial-assistance/student-support-fund/

For tuition fees queries, contact the Tuition Fees team:

020 7594 8011
tuition.fees@imperial.ac.uk

Imperial College Union (ICU) Advice Centre

Imperial College Union runs the Advice Centre independently of the College with advisers on hand to provide free, confidential, independent advice on a wide range of welfare issues including housing, money and debt, employment and consumer rights, and personal safety.

www.imperialcollegeunion.org/advice

Student Hub

The Student Hub represents a single point of contact for all key administrative information and support. The Student Hub team can help you with enquiries about:

- Accommodation (including checking contracts for private accommodation)
Health services

NHS Health Centre and finding a doctor

Even if you are fit and healthy we recommend that you register with a local doctor (GP) as soon as you arrive in London. For help finding your nearest GP see the Student Space website:

www.imperial.ac.uk/student-space/here-for-you/find-a-doctor

There is an NHS Health Centre on our South Kensington Campus which you may visit during clinic hours if you’re feeling unwell. Students living within the practice catchment area are encouraged to register with the Centre.

www.imperialcollegehealthcentre.co.uk

NHS Dentist (based in the Health Centre)

Imperial College Dental Centre offers a full range of NHS and private treatment options.

www.imperial.ac.uk/student-space/here-for-you/dentist

Disability support

Disability Advisory Service

The Disability Advisory Service provides confidential advice and support for all disabled students and students with specific learning difficulties.

If you think you may have dyslexia or another specific learning difficulty but have never been formally assessed, the Disability Advisory Service offers initial screening appointments.
Departmental Disability Officer

Departmental Disability Officers are the first point of contact within your department. They can apply for additional exam arrangements on your behalf, and will facilitate support within your Department.

Your Departmental Disability Officer is

Mrs Louise Green
Undergraduate Office, Room 401
020 7594 6045
l.green@imperial.ac.uk

More information on Departmental Disability Officers is available at:

www.imperial.ac.uk/disability-advisory-service

More information on procedures for the consideration of additional exam arrangements in respect of disability is available at:


If you have any issues regarding a disability that you would like to discuss with your Department, or if you believe you will require special examination arrangements due to a disability, please feel free to speak to Mrs Louise Green in Room 401, or email for an appointment.

Library and IT

Information and Communications Technologies (ICT)

If you’re having problems with technology (including computers, laptops and mobile devices), you can get help from ICT’s Service Desk.

020 7594 9000
www.imperial.ac.uk/ict/service-desk
**Software shop**

The Software shop offers a variety of general and subject specific software programs and packages for free or at a discounted price for Imperial students.

[www.imperial.ac.uk/admin-services/ict/shop/software](http://www.imperial.ac.uk/admin-services/ict/shop/software)

**Central library**

The Central Library at South Kensington is open around the clock pretty much all year. Make sure you find out who your departmental librarian is as they’ll be able to help you find resources for your subject area. Also, don’t forget to check out the Library’s range of training workshops and our other campus libraries for access to specialist medicine and life sciences resources. Alongside these physical spaces and resources, the Library provides over 170,000 electronic books, journals and databases available both on and off campus and a free document delivery service to help you source books and articles from around the UK and the rest of the world.

[www.imperial.ac.uk/library](http://www.imperial.ac.uk/library)

**Departmental library**

The Civil Engineering Library is open exclusively to students and staff of the Department. Funded by the Department, the Library hosts a collection of around 15,000 books, 400 online and print journal titles, a large collection of reports from industry, and historical collections. It is open from 9.30 to 17.00 on weekdays (20.00 on Thursday) with opening extended to 21.00 during examination periods.

Our dedicated Librarian offers support with coursework in one-to-one or group format, including how to find the best information for your study. The Library engages with students via Twitter @CivEngLib.

Further information about the library and its services is available from the library staff and from the Departmental Library webpage:

👤 Callum Munro

📍 Departmental Library, Room 402

[http://www.imperial.ac.uk/civil-engineering/about-us/library/](http://www.imperial.ac.uk/civil-engineering/about-us/library/)

**Institution of Civil Engineers Library (ICE)**

The library located at the Institution of Civil Engineers (ICE) is home to the world’s largest dedicated collection of civil engineering materials. In addition to printed books and journals, the ICE library also offers access to a number of digital services, including e-books and advanced search tools, and a quiet place to work. All ICE members can borrow up to three items in person, or by post.
Religious support

The Chaplaincy Multi-Faith Centre has chaplains from many different religions, as well as prayer rooms and information on places of worship. In addition, it runs meditation classes and mindfulness workshops for stress management. There is a student-run Islamic prayer room on campus and separate areas available for male and female Muslims.

www.imperial.ac.uk/chaplaincy

Support for international students

English language support

The Centre for Academic English provides free in-sessional English courses for international students while they are studying. These include classes and workshops on academic language, social language, the four skills of reading, writing, listening and speaking, 1-1 consultations with a tutor to work on a piece of academic writing or an oral presentation, self-study resources in the VLE Blackboard, and the Conversation Project, which partners students with a native-speaker volunteer to practise social and conversational English.

www.imperial.ac.uk/academic-english

International Student Support team

Students from outside the UK make up around half of our student population, so our International Student Support team offers year-round support to help our international students settle into Imperial life. This includes UK visa and immigration advice and trips to different places of interest.

www.imperial.ac.uk/study/international-students
The Student Records and Data team are responsible for the administration and maintenance of the student records for all students studying at the College. This includes enrolments, programme transfers, interruption of studies, withdrawals and processing of examination entry for research degree students. The team also use this information to fulfil reporting duties to the Student Loans Company, Transport for London and the UKVI, as well as other external bodies.

The team is currently responsible for the processing of student results and awards on the student record system as well as the production and distribution of academic transcripts and certificates of award.

Student Records and Data produce a variety of standard document requests for both current and previous students including council tax letters, standard statements of attendance and confirmation of degree letters.

Appeal administration also sits within the team, as does the responsibility for confirming qualifications via the Higher Education Degree Datacheck service.

**Student records and examinations**

📞 +44 (0)20 7594 7268  
✉️ records@imperial.ac.uk

**Degree certificates**

📞 +44 (0)20 7594 8037  
✉️ certificates@imperial.ac.uk
The pace and intensity of postgraduate study at Imperial can be demanding so it’s important to find time for outside interests.

**Civil Engineering Society (CivSoc)**

The Civil Engineering Society is the departmental student society, of which all Undergraduate and Postgraduate students are automatically members. Run by an elected committee of students, CivSoc is one of the most active departmental societies in the College and organises regular events throughout the academic year. These include numerous lunchtime lectures given by industrial companies, site visits, social events and parties. The highlight of the CivSoc year is the extremely popular international trip in the spring, open to all students in the Department. Additionally, CivSoc writes and publishes the departmental student newspaper LIVIC.

All students are encouraged to participate in CivSoc-run activities. Announcements concerning upcoming events and society news are emailed to all members, displayed on the screen in the second floor Breakout Student Space, as well as being available on CivSoc’s website and social media pages.

**Chair:** Susie McAllister

**Treasurer:** Yimo Yan

**Secretary:** Max Castello

**Industrial Liaison Officer:** Cheng Kwang

**Tour Officer:** Hippolyte Mounier-Vehier

**Events Officer:** Christina Trigle

**LIVIC Editor:** Jian Chew

**Marketing and Web Officer:** Remi Pelletier

**Alumni and Mums & Dads:** Ottilie Shiyong Liu

**Department Representative:** Marthe Boulleau
Imperial College Union

The Union’s range of 375+ student-led clubs, societies and projects is one of the largest of any UK university, opening up lots of ways for you to enjoy your downtime.

www.imperialcollegeunion.org/about-us

Graduate Students’ Union

The Graduate Students’ Union is the postgraduate arm of Imperial College Union. The GSU works alongside the Imperial College Union President to ensure that the requirements of postgraduate students are catered for. It also organises a number of academic and social events during the year.

www.union.ic.ac.uk/presidents/gsu

Sport

Imperial College has a wide range of sports and activities on offer that cater for all standards and abilities. We have a recreational activity offer, competitive sports teams and an elite sport programme. We are dedicated to ensuring we have a diverse, inclusive and exciting offer for all.

After a one off induction fee of £40 you will get free use of the gym and swimming facilities on our campuses.

www.imperial.ac.uk/sport
14. Student feedback and representation

Feedback from students

The College and Union is committed to continually improving your education and wider experience and a key part of this is your feedback. Feedback is thoroughly discussed by your student representatives and staff.

Student representation

Student Representatives are recruited from every department to gather feedback from students to discuss with staff. More information about the role, and instructions on how to become an academic representative, are available on the Imperial College Union (ICU) website.

www.imperialcollegeunion.org/your-union/your-representatives academic-representatives/overview

Due to the number and complexity of our MSc programme configuration, elections to the positions of Programme Student Representatives are managed within the Department. You will be advised of the processes, both on self-nomination for the positions, and the selections processes, during the cluster induction sessions. Typically we look for one representative from each of the core programmes and one or two from Business Management.

Staff-Student Committee

The Staff-Student Committee is designed to strengthen understanding and improve the flow of communication between staff and students and, through open dialogue, promote high standards of education and training, in a co-operative and constructive atmosphere. College good practice guidelines for staff-student committees are available here:

www.imperial.ac.uk/about/governance/academic-governance/academic-policy/student-feedback

There are three committees: Undergraduate, Master’s and Research Students/Staff. They meet once each term, and their remit is as follows:

- To provide a forum for debate about important matters.
- To receive feedback from students.
- To initiate enquiries or investigations on matters of concern to students.
- To represent the interests and requirements of the student body.
- To air grievances.

The membership is drawn from the student body, with members being elected by their peers at the beginning of term, the Student Union, the Graduate Student Association and relevant Departmental Officers.

The Undergraduate SSLC is chaired by the Director of Undergraduate Studies and both the MSc and PhD are chaired by the Postgraduate Tutor, with the Departmental Postgraduate Representative acting as Deputy-Chair.
15. Student surveys

Your feedback is important to your Department, the College and Imperial College Union. Whilst there are a variety of ways to give your feedback on your Imperial experience, the following College-wide surveys give you regular opportunities to make your voice heard:

- PG SOLE lecturer/module Survey
- Student Experience Survey (SES)
- Postgraduate Taught Experience Survey (PTES) – next due to run in spring 2018

The PG SOLE lecturer/module survey runs at the end of the autumn and spring terms. This survey is your chance to tell us about the modules you have attended and the lecturers who taught them.

For PG SOLE your lecturers will receive their individual numerical results and comments shortly after the survey closes. To make the most of your opportunity to give your feedback, please do not use offensive language or make personal, discriminatory or abusive remarks as these may cause offence and may be removed from the results. Whilst this survey is anonymous, please avoid self-identification by referring to personal or other identifying information in your free text comments.

The Student Experience Survey (SES) is another opportunity to leave your views on your experience. This survey will cover your induction, welfare, pastoral and support services experience.

The Postgraduate Taught Experience Survey (PTES) is the only national survey of Master’s level (MSc, MRes, MBA and MPH) students we take part in. This is the only way for us to compare how we are doing against the national average and to make changes that will improve our Master’s students’ experience in future. PTES covers topics such as motivations for taking the programme, depth of learning, organisation, dissertation and professional development. PTES last ran in spring term 2016 and will run again in spring 2018.

All these surveys are anonymous and the more students that take part the more representative the results so please take a few minutes to give your views.

The Union’s “You Said, We Did” campaign shows you some of the changes made as a result of survey feedback:

_website_ www.imperialcollegeunion.org/you-said-we-did_

If you would like to know more about any of these surveys, or see the results from previous surveys, please visit:

_website_ www.imperial.ac.uk/students/academic-support/student-surveys/pg-student-surveys_

For further information on surveys, please contact the Registry's Surveys Team at:

_email_ surveys.registysupport@imperial.ac.uk_
16. And finally

Alumni services

When you graduate you will be part of a lifelong community of over 190,000 alumni, with access to a range of alumni benefits including:

- Discounts on further study at the College and at Imperial College Business School.
- Alumni email service.
- Networking events.
- Access to the Library and online resources.
- Access to the full range of careers support offered to current students for up to three years after you graduate.
- Access to our Alumni Visitor Centre at the South Kensington Campus, with free Wifi, complementary drinks, newspapers and magazines, and daytime left luggage facility.

Visit the Alumni website to find out more about your new community, including case studies of other alumni and a directory of local alumni groups in countries across the world.

www.imperial.ac.uk/alumni

Opportunities for further study

After you have completed your Master’s programme, you may choose to continue your studies on a PhD, CDT or other CPD programme at Imperial.

http://www.imperial.ac.uk/civil-engineering/prospective-students/postgraduate-research-admissions-phd-engd-mphil/

Explore the Departmental Alumni Profiles to find out what previous graduates have gone on to achieve:

http://www.imperial.ac.uk/civil-engineering/alumni/alumni-profiles/
17. **Appendix A: Monitoring Attendance**

Since the introduction of Tier 4 of the Points Based System in March 2009, the College has held a license permitting us to sponsor the visas of students from outside the European Union to enable them to attend our courses.

Sponsorship of students, under our Tier 4 Visa License, brings with it an obligation for us to inform the Home Office whenever we withdraw sponsorship from a student. This may be as a result of a student withdrawing or being expelled from their course, interrupting their studies, or not being in attendance. This is reflected in the College’s regulations and procedures to ensure the welfare and academic progress for all students. See Academic Regulation Paragraph 9.4 of the General Regulations for Students:


The College does not wish to discriminate in its treatment of students from outside the European Union, and so all procedures for monitoring attendance and reporting student activity apply equally to all students.

The procedure for compliance adopted for the Master of Science Programme within the Department of Civil and Environmental Engineering is to base the monitoring of attendance around a number of ‘check-points’, which are:

- Start-of-Session Induction.
- Confirmation of attendance at the Health and Safety Induction, which is a requirement of the College for issue of ID cards.
- Submission of selected items of coursework.
- Attendance at Field Trips/Site Visits.
- Examinations and Progress Tests.
- Randomly selected lectures/laboratories/tutorials.
- Scheduled meetings with Personal Tutors and/or Project Supervisors.

In order to make this process efficient, the following shall apply.

- The Cluster Administrator shall conduct the monitoring using a class list supplied by Imperial College Registry.
- There shall be one location (which will be notified to you by email) for the submission of randomly selected coursework related assessment items.
- Each student shall sign the class list at each check-point.
- The Cluster Administrator shall inform the relevant Senior Tutor and Course Director of any student who fails to interact with the College on three consecutive occasions.
- The student will be invited for interview, and a warning issued.
- If non-attendance continues, the Senior Tutor shall inform the Head of Department and the College Registry.
- The Imperial College Registry report directly to relevant authorities, including HEFCE, the UK-VI and sponsors.

The Department expects students to demonstrate their commitment to their degree programme by attending lectures and submitting coursework on time. If students cease to
engage properly with the course, e.g. by being absent without permission or adequate cause, this may be reported to the relevant authorities, and may result in being asked to leave the College. In the case of those attending with Student Visas, this could jeopardise the individual’s ability to stay in the UK.

**Internships**

Postgraduate students can only undertake work placements if they are an approved part of their course of study. Students who may wish to interrupt their studies to take an internship (in the UK or overseas) will have the sponsorship of their visa withdrawn and will need to apply for a new visa in order to return to their course at a later date.
Department of Civil and Environmental Engineering

Postgraduate Taught (MSc): Recording of External Study Leave Form
(please see notes overleaf)

This form must be completed by the Student and Supervisor and returned to the Cluster Administrator for processing

<table>
<thead>
<tr>
<th>CID No:</th>
<th>Date of Initial Degree Registration:</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Student’s Surname:</th>
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</table>

<table>
<thead>
<tr>
<th>Student’s Forename(s):</th>
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</thead>
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<table>
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<tr>
<th>Supervisor(s) (print name(s)):</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Research Topic</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Are you a Tier 4 Student?</th>
<th>If yes, please seek advice immediately from the Visa Compliance Team (see notes)</th>
<th>YES / NO</th>
</tr>
</thead>
</table>

List any previous periods of external study leave:

**Details of External Study Leave**

<table>
<thead>
<tr>
<th>Details of remote location:</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Departure date:</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Return date:</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Purpose and relevance of external study leave:</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Eg. Site visits, field work, remote data gathering</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Details of remote contact: (in case of emergency)</th>
</tr>
</thead>
</table>

The following to be completed by the principal supervisor

I approve this period of study leave and confirm that I will maintain regular contact with the student named above

<table>
<thead>
<tr>
<th>Signature of supervisor(s):</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Date:</th>
</tr>
</thead>
</table>
Recording Study Leave.

This form should be used to cover any and all study time which is spent outside of the UK. for the following situations:

a. Field work and data collection.
b. Study Leave which is not subject to the Placement Learning Policy, such as extended field work. The College’s Off-Site Working procedures should be followed: [http://www.imperial.ac.uk/safety](http://www.imperial.ac.uk/safety)
c. For Tier 4 students the College is required by UKVI to report any time away from the College as a ‘change of study location’ within 10 days of this change taking place. This will not impact on a student’s visa status in the UK.

The form to be:

- completed by the student,
- authorised by the supervisor
- submitted to the Cluster Administrator (who will file a digital copy with the General Office, Skempton Building (cvpgo@ic.ac.uk))

The General Office will be responsible for any further notifications required.

For students with Tier 4 visas

The Visa Compliance Team may be contacted by email on [visacompliance@imperial.ac.uk](mailto:visacompliance@imperial.ac.uk) for advice.

Queries regarding this form should be addressed to Fionnuala in the General Office or by email to [flo@ic.ac.uk](mailto:flo@ic.ac.uk).
Appendix B: Disabilities Statement

Information for students with disabilities, specific learning difficulties or long-term health issues

At Imperial College we recognise that studying at university can be a challenge, especially if you have a disability. We are keen that you have every opportunity to fulfil your potential and graduate with the degree you deserve. It is therefore important that you let us know about any disability, specific learning difficulty or health problem as soon as possible so that we can arrange expert advice and support to enable you to do this.

Some people never think of themselves as having a disability, but students who have experienced any of the issues listed below have found that a little extra help and support has made all the difference to their study experience.

- Specific learning difficulties (such as dyslexia, dyspraxia, AD[H]D).
- Autistic spectrum disorder (such as Asperger’s).
- Deafness or hearing difficulties.
- Long term mental health difficulties (such as chronic anxiety, bipolar disorder, depression).
- Medical conditions (such as epilepsy, arthritis, diabetes, Crohn’s disease).
- Physical disabilities or mobility impairments.
- Visual difficulties.

Where to find help:

Departmental Disability Liaison Officer

Mrs Louise Green
l.green@imperial.ac.uk
Room 401
020 7594 6045

Mrs Green is your first point of contact within your Department and is there to help you with arranging any support within the Department that you need. She is also the person who will apply for special examination arrangements on your behalf. You need to contact her without delay if you think that you may need extra time or other adjustments for your examinations.

Disability Advisory Service

The Disability Advisory Service works with individual students no matter what their disability or level of study to ensure that they have the support they need. Our advisors are committed to providing the best possible support for all students at Imperial College. They understand that each person's disability can affect them in different ways and therefore the support offered is flexible and tailored to you. We can also help if you think that you may have an unrecognised study problem such as dyslexia. The Service is confidential and information about your support needs is only passed on to others within the College with your agreement and then only in order that you are fully supported. Our advisors never pass on information outside the College or to parents unless you ask them too.
Some of the sorts of things the Disability Advisors can help with are:

- Checking that your evidence of disability is appropriate and up-to-date.
- Arranging a diagnostic assessment for specific learning difficulties.
- Making recommendations for additional exam arrangements, for example extra time or rest breaks.
- Drawing up a “Suggested Reasonable Adjustment” document for you to share with your Department which outlines all of your support needs.
- Arranging and funding the support you need. This can include:
  - Note taking, study skills or mentoring support.
  - Purchasing disability related equipment (NOT computers).
  - Funding taxis for those who need help with transport.
- Help with arranging extra Library support and access to the Assistive Technology Suite
- Supporting applications, where appropriate, for continuing accommodation for your second or later years.

A disability is any long-term condition that has a substantial impact on your ability to study effectively, such as:

- A specific learning difficulty, e.g. dyslexia, dysgraphia.
- An enduring mental health condition, e.g. depression, OCD, generalised anxiety disorder.
- A visual, hearing or other sensory impairment.
- A long-term medical condition, e.g. IBS, ME, diabetes.
- A social/communication difficulty, e.g. autistic spectrum/Asperger’s syndrome.
- A mobility or dexterity issue.
19. Appendix C: Revision and Exam Stress

Stress

During revision and exam periods, anxiety and stress are very common problems for students – even for those who appear confident and calm. Don’t despair; you are not alone.

A small amount of anxiety can actually be beneficial, it can make you alert and focused, but too much anxiety means you will have trouble thinking clearly and this means you aren’t likely to do your best work.

What exactly is stress?

Stress is the body’s normal response to a challenge, threat or excitement. The consequence of stress depends largely on how you interpret the physical symptoms; it can help motivate you or it can paralyse you.

Take the following scenario:

- Joe: a student just before a critical exam
- Jane: an athlete just before a big competition
- Both Joe and Jane are aware of the same physical symptoms:
  - sweaty palms
  - racing heart
  - knot or butterflies in the pit of the stomach

Joe, the student, feels distressed by his symptoms and views them negatively, as if the symptoms are a sign of impending failure. Joe may have trouble sleeping and spend a lot of time worrying about his physical condition and the upcoming exam.

Jane, the athlete, interprets her symptoms as a sign that she can motivate herself to perform well. She views the symptoms as evidence that she is “psyching herself up” for the big competition.

The bottom line?

Stress can be a barrier to optimal performance or a motivating agent; it all depends on how you interpret, label and manage what you are experiencing.

The trick is to figure out what level of stress is motivating for you and what amount is paralysing and then work to keep it in the motivating zone.

Anxiety

Anxiety is very common and many people find ways of overcoming it or coping with it without seeking professional help. However, for some people anxiety can be harmful, it can affect your physical health, or your fears can take over your life and stop you doing the things you want to do. The good news is that there are things you can do to help.
Managing anxiety

1) Identify trigger factors
The first step in managing anxiety is to identify the specific situations that are making you stressed or anxious and when you are having trouble coping. One way to do this is to keep a diary of symptoms and what is happening when anxiety occurs. It is also helpful to identify any worrying thoughts as this can lead to finding ways to solve the specific problem that is of concern.

2) Thought management
Thought management exercises are useful when a person is troubled by ongoing or recurring distressing thoughts. There are a range of thought management techniques. For example, you can use distraction with pleasant thoughts. This can help take attention away from unpleasant thoughts. Alternatively, one can learn ‘mindfulness techniques’ to direct attention away from negative thinking and treat thoughts as just thoughts and not facts. The choice of thought management technique will depend on the type of anxiety problem. A psychologist can help you decide on thought management strategies that are likely to be most helpful.

3) Talk about it
Try a friend or relative who you trust and respect, and who is a good listener.

4) Learning to relax
People who feel anxious most of the time report that they have trouble relaxing. Knowing how to release muscle tension is an important anxiety treatment. Learning a relaxation technique and practising it regularly can help a person to maintain a manageable level of anxiety. You can learn these through groups, with professionals, but there are several books and self-help materials you can use to teach yourself. It’s a good idea to practice relaxation regularly, not just at times of crisis.


Managing revision stress

Take a look at the three categories outlined below and see which one best describes the type of student you are. Some students get stuck in one pattern – others may pass through each phase.

When you have identified what type of student you are or what phase you are currently in, click on the appropriate link below for tips on how to help yourself.

Which type of student are you?

1. The Self-Indulgent student
   - denial of responsibility / or overconfident
   - not lazy, but has low frustration tolerance
   - escapist tendencies
   - requires stimulus to raise anxiety (e.g. approaching deadline)
2. The Tense & Fearful student

- denial of potency – deskilling self unnecessarily
- self-critical, low self-esteem
- overwhelmed by the importance of the exam, pressure to succeed

3. The Perfectionist student

- denial of vulnerability, wanting total control
- critical of the "system", passive-aggressive
- sets impossible goals, so never feels “good enough” or “safe enough”
- obsessive, workaholic tendencies; or procrastination

Study and exam strategies

Organise

- Sort out your topics for revision. Base selection of topics on syllabus and examination requirements, on predictions derived from past papers and on guidelines suggested by tutors.
- Devise a routine of study periods that is realistic and productive, and includes rest intervals!
- Pay attention to diet, sleep and recreation – all are important factors in maintaining balance and keeping stress levels under control.
- Breakdown targets into manageable units. Ticking off completed units creates a sense of forward movement. A checklist for the day’s targets (making sure the targets are realistic and achievable) can also boost morale.
- Use your time wisely – deal with less demanding tasks in periods of the day when you are less alert or focused. If you find yourself struggling unproductively with a problem, take a break or switch to some other work.

Maximise your learning

- The more you actively interact with the subject matter, making it your own, and linking it to previous knowledge, the more meaningful and memorable it becomes.
- Follow the PQRST model:
  - **Preview** – skim the material to get an overall preview
  - **Questions** – formulate questions that highlight what you aim to derive from your reading
  - **Read Actively** – make appropriate notes of key ideas
  - **Summarise** – identify the main points using lists, key words, flow diagrams, etc. and connect them with knowledge from other sources
  - **Test** – test yourself by reciting and reviewing the summaries immediately after learning the material and again at later intervals

Tips
- Use flow diagrams, keywords or patterns linking ideas to make master summaries for revision purposes.
- Use cue cards! Index-sized “flash” cards are easy to carry around and are useful for learning information you find particularly hard to remember. You can put facts, figures, formulae on the cards and use colours, keywords, mnemonics and other memory aids to help you learn.
- Space your studying and give yourself time for the information to sink in. Study related topics together and take regular, short breaks at suitable “achievement points”.
- Compare notes with other students and get feedback and/or clarification from tutors.

**General exam strategies**

**Conquering exams: strategies and skills**

- **Practical preparation**: Check the time and venue of the exam and figure out how to get there in good time, and have the necessary equipment ready (e.g. pens, ID card, clear bottle of water etc.)
- **Emotional preparation**: Mentally rehearse how to tackle the exam as a whole and review your strategies for dealing with anxiety. Consider what might also help, for example, staying away from crowds gathering outside exam halls.
- **Memory considerations**: Systematically review your revision notes the night before or the morning of the exam, but don’t attempt to learn complex new material at this late stage. Capitalise on short-term memory by glancing at your “difficult” cue cards just before entering the exam hall, then try reproducing them immediately when you are allowed to start.

**Exam skills**

Read the exam paper carefully and underline key words and instructions.

Don’t panic – if you feel unable to answer any of the questions at this stage it is likely due to a surge in anxiety.

- Note how many questions you are required to answer and if any are compulsory.
- Tick the questions you intend to answer. Make a rough timetable, allocating equal time to equally weighted questions. Allow for about 15 minutes of “planning” and 10 minutes of “finishing off” time overall for a typical 3 hour exam.
- Avoid getting demoralised at the start. Answer the easiest question first and save the most difficult one for last. Attempt all the questions required – usually the first 50% of marks for any question are easier to obtain than the next 50%.
- Watch the wording of the questions. Answering a question that wasn’t asked means no marks, no matter how thoughtful your answer was!
- Jot down key ideas that emerge about any of the questions and use them for “planning” an answer. This might show the examiner what you had in mind in case you run out of time.
Save the last 5-10 minutes for “finishing touches” e.g. crossing out unwanted script, ensuring that questions are clearly numbered, and that all answer books have your identification number.

**Sitting the exam**

**What if I get a mental block during an exam?**

- Give yourself a couple of minutes to try to remember or puzzle out the answer. If you are still blocked, move on to the next question. If ideas for dealing with the question pop up while working on another one, jot them down before you forget them.
- With mathematical questions it pays to stick with the problem a bit longer, say 10 minutes. Try thinking back to first principles or representing the problem diagrammatically or more concretely, or think laterally about related issues.
- Adjust your timetable and still attempt all the required questions.

**What if I panic during an exam?**

If you start panicking in the exam, and you find that the harder you try to work the worse you feel, practise “Stop the Wasp”:

- **STOP** – the self-defeating thoughts that are buzzing around like wasps. Tell yourself instead that you are going to survive this experience, come what may. Go through the following “W-A-SP” squashing procedure, which you’ll need to practise during milder forms of anxiety in the revision period (so you can learn to recognise the early stages of panic, which are easier to neutralise).
- Familiarity with the procedure, through practice and mental rehearsal is essential emotional preparation.
- **WAIT** – switch off and unwind for a few moments. Focus on breathing and then relax with eyes closed. This will help you return to the task afterwards with a calmer, clearer mind and a more constructive perspective.
- **ABSORB** – taking in the relaxation, flood your mind with constructive self-talk (ideally from a repertoire of previously prepared and practised phrases), then slowly open your eyes and calmly bring yourself to face the exam situation.
- **SLOWLY PROCEED** – calmly get going again with the paper, as best you can, one step at a time.

**Keep in mind:**

- When focusing on your breathing, take a long, slow, deep breath, and allow the air to flow out slowly and smoothly. Sit back comfortably, dangling your arms by your side, and imagine any tension flowing out through your hands and feet. Try any relaxation strategy that works for you.
- If your breathing pattern has been rapid and shallow, you may be at risk of hyperventilating. Instead, pause after long exhalations, and breathe you’re stomach rather than upper chest, movements. If you continue to hyperventilate, breathe into cupped hands (or even a paper or plastic bag – take one along if you think you’ll need it).
- It may help to reframe your attitude towards the examiner. Instead of some sadistic, persecuting figure, imagine him or her as a friend, or someone who just wants some help with the question.
Repeat “Stop the Wasp” if necessary – you may have rushed back too soon the first time. Stay longer “waiting” and “absorbing”. If the panic continues or escalates, tell the invigilator without delay.

**After the exam**

Don’t indulge in post-mortems and comparisons with others. Review what went well in your overall approach, including how you handled anxiety, and aim to improve upon it in your next exam.
The Policy and Procedures contained in this document apply to all students and former students at Imperial College registered for Imperial College or University of London awards. A complete copy of the College regulations governing Cheating Offences: Policy and Procedures, under which Plagiarism is categorised, is available to download from the following link:


In any proceedings under these Policy and Procedures, the student shall be presumed to be innocent until the contrary is established beyond reasonable doubt.

Where the offence is an instance of suspected plagiarism, it shall be dealt with in accordance with the following procedures, commensurate with the severity of the suspected offence.

If you are not sure, please ask. Useful reference points are academic and library staff.

**Plagiarism** is defined as the presentation of another person’s words, ideas, judgement or data as though they were your own. For example; not referencing the source of your ideas or arguments when they have derived from your reading; taking verbatim the words of someone else’s work and putting it into your project without quotation marks and referencing; taking whole sections out of books, the internet, articles, lecture notes, other reports or other students’ work, and including them in your report uncited. Plagiarism may also occur in formal written examinations - the above document addresses this possibility. An example might be where candidates have been able to learn text by heart (by rote) and simply reproduce this without acknowledgement of source. Where the examination is based on technical knowledge, this may be acceptable and not regarded as plagiarism. In other subjects where candidates are asked to write essay-type questions, the examiners may regard text reproduced without reference or critical analysis as plagiarism. This will be clarified, where appropriate, in the examination rubric on the front page of the examination paper.

You should be aware that you have a collective responsibility for the integrity of group work submitted for assessment. This means that if part of the work is plagiarised, all group members will be held accountable unless proof can be provided by each individual member of their contribution. You should, therefore, retain an audit trail of your contribution for this purpose.

When submitting (both individual and group) assessed coursework you will be required to complete and attach a Coursework Cover Sheet (examples on the following page) confirming that you have read and understood the definition of plagiarism. Submitting this form will certify that the work presented is entirely your own, except where indicated.

Plagiarism is a serious offence. The Examination Board reserves the right to take further action as it deems appropriate to protect the name of the Department and the College, and this may involve expulsion of a student from the programme or delay or withdrawal of a degree award.
## Coursework and Project Cover Sheet

**MSc in Environmental Engineering Cluster**

**Department of Civil and Environmental Engineering**

<table>
<thead>
<tr>
<th>Surname</th>
<th>First Name</th>
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<th>Module</th>
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<tr>
<th>Supervisor</th>
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<table>
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<tr>
<th>Submission Date</th>
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</table>

### DECLARATION

I certify that I have read the definition of plagiarism given overleaf, and that the work submitted for this coursework assignment is my own work, except where specifically indicated otherwise. In signing this document I agree that this work may be submitted to an electronic plagiarism test at any time and I will provide a further version of this work in an appropriate format when requested:

**Signature:** __________________________ **Date:** __________________________

**Note:** Until an assignment carries this completed front page it will not be accepted for marking. If the front page is absent, the delay in getting it added may result in a penalty for late submission.

### TO BE COMPLETED BY THE MARKER

<table>
<thead>
<tr>
<th>Grade awarded: __________________________</th>
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<table>
<thead>
<tr>
<th>Late penalty applied: __________________</th>
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</thead>
</table>
Module ____________________________________________________________

Assignment __________________________________________________________

Deadline ____________________________________________________________

DECLARATION

I certify that I have read the definition of plagiarism given overleaf, and that the work submitted for this coursework assignment is my own work, except where specifically indicated otherwise. In signing this document I agree that this work may be submitted to an electronic plagiarism test at any time and I will provide a further version of this work in an appropriate format when requested:

Name: ____________ CID: ________ Signature: ____________ Date: ____________

Name: ____________ CID: ________ Signature: ____________ Date: ____________

Name: ____________ CID: ________ Signature: ____________ Date: ____________

Name: ____________ CID: ________ Signature: ____________ Date: ____________

Name: ____________ CID: ________ Signature: ____________ Date: ____________

Name: ____________ CID: ________ Signature: ____________ Date: ____________

Note: Until an assignment carries this completed front page it will not be accepted for marking. If the front page is absent, the delay in getting it added may result in a penalty for late submission.

TO BE COMPLETED BY THE MARKER

Grade awarded: ________________________________

Late penalty applied: ________________________________
22. Appendix F: Map of South Kensington Campus
Building Key:

1. Beit Quadrangle
   Beit Hall, Chagall Hall, Imperial College Union
2. Imperial College Union
3. Ethos Sports Centre
   Sport Imperial
4. Prince’s Gardens, North Side
   No.8: Early Years Education Centre
   No.10-12: Garden Hall
   No.15: Centre for Environmental Policy
5. Wells Hall
6. Blechett Laboratory
   Physics, Institute of Solid State Physics
7. Roderic Hill Building
   Aeronautics, Biology, Centre for Process Systems Engineering, Chemical Engineering, Composites Centre
8. Bone Building
   Aeronautics, Chemical Engineering
9. Royal School of Mines
   Earth Science and Engineering, Materials
10. Aston Webb
    Earth Science and Engineering
11. Bessemer Building
    Centre for Blast Injury Studies, Bioengineering, Imperial Incubator, Institute of Biomedical Engineering, Institute for Systems and Synthetic Biology
12. Goldman Sachs Building
    Bioengineering, Materials
13. Hudson Building
    Computing, Institute of Shock Physics, Mathematics, Physics
14. ACE Extension
    Aeronautics, Chemical Engineering
15. William Penney Laboratory
    London e-Science Centre
16. Electrical Engineering Building
    Electrical and Electronic Engineering, Energy Futures Lab
17. Business School
    Centre for Quantitative Finance, Innovation Studies Centre, Entrepreneurship Centre, Centre for Health Management
18. 53 Prince’s Gate
    Business School
19. Facetside
    Gabor Hall, unbolt Hall, Wilkinson Hall, Eastside bar and restaurant, Essentials convenience store
20. Sherfield Building
    Level 1: Catering, Centre for Health Policy, Queen’s Tower Rooms, Security Reception
    Level 2: Bank (Sanzander), Fuel Stop, Great Hall, Junior Common Room, Newsagent, QT snack bar, Senior Common Room, Union Shop
Level 3: Academic Visitors’ Accommodation, Centre for Co-Curricular Studies, Conference Office, Equality and Diversity Unit, Finance, Graduate School, HR Personnel, Human Resources, International Office, Outreach, Centre for Continuing Professional Development, Registry, Sports Imperial, Student Accommodation Centre, Student Hub
Level 4: Archives, Continuing Professional Development Unit, ICT, ICT Helpdesk, Occupational Health Service, Safety Department
Level 5: Rhythm Music and Arts Centre, Cenac Christian Science Centre, Communications and Public Affairs, Development, Educational Development Unit, Estates (Projects, Facilities, Finance, Property Management) Read and Pippard Lecture Theatres, Seminar and Learning Centre (SALC)
21. Grantham Institute for Climate Change
22. Faculty Building
    Academic Health Science Centre (AHSC), Central Secretariat, Climate-KIC, Communications and Public Affairs, Corporate Partnerships, Faculty of Medicine and Natural Sciences
    Administration, Finance, Human Resources, Institute for Security Science and Technology, Institute of Global Health Innovation, Planning, President & Rector’s Office, Research Services
23. 58 Prince’s Gate
    Ballroom, Billiard Room, Boardroom, College Room, Garden Room, Imperial Consultants, Oat Room, UK Energy Research Centre
24. 170 Queen’s Gate
    Council Room, Dining Room and Solar, President & Rector’s Residence
25. Imperial College London and Science Museums
    Libraries
    Central Library, Library Archive and Special Collections, Science Museum Library
26. Queen’s Tower
    27. Sloane Building
    Civil and Environmental Engineering Centre for Environmental Control and Waste Management, Centre for Transport Studies, Wohl Reach Out Lab
28. Mechanical Engineering Building
    ICT, Mechanical Engineering, Vibration University Technology Centre
29. Southside
    Falmouth Keogh Hall, Sekirk Hall, Tizard Hall, Health Centre, Dentist
30. Sir Ernst Chain Building – Wolfson Laboratories
    Biology, Cell and Molecular Biology, Centre for Bioinformatics, Electron Microscopy Centre, Glycobiology Training, Molecular Biocatalysis, Research and Infrastructure Centre, Centre for Structural Biology
31. Flowers Building
    Cell and Molecular Biology, Centre for Integrative Systems Biology and Bioinformatics, Chemistry, Electron Microscopy Centre, MRC Centre for Molecular Bacteriology and Infection
32. Chemistry Building
    Chemistry
33. Sir Alexander Fleming Building
    Medicine, Biology, Biomedical Sciences, Cell and Molecular Biology, Molecular Biosciences
34. Chemistry RC31
    Biochemistry, Biology, Centre for Photomolecular Sciences, Chemistry
35. 52 Prince’s Gate
    Imperial Innovations
36. Alumni Visitor Centre
    College Cafe
23. Appendix G: Health and Safety

Student Health & Safety Handbook
Department of Civil & Environmental Engineering
SKEMPTON BUILDING

HEALTH AND SAFETY CONTACT INFORMATION

Emergency procedures:

- **MEDICAL, FIRE or SECURITY EMERGENCIES** - DIAL 4444 or 020 7589 1000
- **FIRST AID** – Contact the nearest First Aider (see separate sheet)
- **BUILDING EVACUATION** – Know your evacuation route, use the nearest staircase (east, west or central stairs). **DO NOT USE THE LIFTS.** Leave the building quickly and safely. Do not return to collect personal
- **ACCIDENTS + DANGEROUS OCCURRENCES** – All accidents and near misses, however minor, MUST BE REPORTED using the online system “SALUS”

### Department Emergency Control Team

<table>
<thead>
<tr>
<th>Role</th>
<th>Office</th>
<th>Name</th>
<th>Tel.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Head of Department</strong></td>
<td>442</td>
<td>Prof N. Buenfeld</td>
<td>45955</td>
</tr>
<tr>
<td><strong>Department Safety Officer</strong></td>
<td>413</td>
<td>Dr G. D. Fowler</td>
<td>45973</td>
</tr>
<tr>
<td><strong>Technical Services Manager</strong></td>
<td>417</td>
<td>Mr B. Whiting</td>
<td>46895</td>
</tr>
<tr>
<td><strong>Department Operations Manager</strong></td>
<td>440A</td>
<td>Mrs L. A. Cumming</td>
<td>42715</td>
</tr>
<tr>
<td><strong>Assistant to the Technical Services Manager</strong></td>
<td>309</td>
<td>Mr S. Hullock</td>
<td>45869</td>
</tr>
</tbody>
</table>

### Building Health and Safety Committee

<table>
<thead>
<tr>
<th>Role</th>
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<th>Name</th>
<th>Tel.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Chairman of Department Safety Committee</strong></td>
<td>417</td>
<td>Mr B. Whiting</td>
<td>46895</td>
</tr>
<tr>
<td><strong>DSO; EWRE Rep.; COSHH, Radiation, Fieldwork &amp; Biological Safety Advisor</strong></td>
<td>413</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Manual Handling Assessor</strong></td>
<td>236</td>
<td>Mr T. Stickland</td>
<td>43224</td>
</tr>
<tr>
<td><strong>Committee Secretary, DSE Assessor, Fleet Manager</strong></td>
<td>309</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>First Aid Coordinator</strong></td>
<td>507</td>
<td>Dr A. Nievas-Pino</td>
<td>41214</td>
</tr>
<tr>
<td><strong>Fluid Mechanics Section Academic Safety Representative; Laser Safety</strong></td>
<td>328A</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Geotechnics Section Academic Safety Representative</strong></td>
<td>528B</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Structures Section Academic Safety Representative</strong></td>
<td>228B</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Transport Section Academic Safety Representative</strong></td>
<td>337</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>UG Student representative (Dept. Rep.)</strong></td>
<td></td>
<td>Miss M. Boulleau</td>
<td></td>
</tr>
<tr>
<td><strong>PG Student representative</strong></td>
<td></td>
<td>Vacancy</td>
<td></td>
</tr>
<tr>
<td><strong>Post-Doctoral Research Staff Representative</strong></td>
<td></td>
<td>Vacancy</td>
<td></td>
</tr>
<tr>
<td><strong>Skempton Building Manager (Office in City &amp; Guilds Building)</strong></td>
<td>C&amp;G 260</td>
<td>Mr G. Fairhurst</td>
<td>49639</td>
</tr>
<tr>
<td><strong>Assistant Skempton Building Manager (Office in City &amp; Guilds Building)</strong></td>
<td>C&amp;G 260</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Department of Aeronautics DSO (Office in City &amp; Guilds Building)</strong></td>
<td>C&amp;G 222</td>
<td>Dr N. MacCarthy</td>
<td>45043</td>
</tr>
<tr>
<td><strong>Department of Mechanical Eng. DSO (Office in City &amp; Guilds Building)</strong></td>
<td>C&amp;G 329</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Department of Mechanical Eng. Workshop Manager</strong></td>
<td>238A</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Wohl Reach Out Laboratory</strong></td>
<td>100</td>
<td>Ms S. Konnur</td>
<td>41924</td>
</tr>
<tr>
<td><strong>Faculty of Engineering Safety Manager (Desk in Faculty Building L2)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Imperial College Safety Department (level 4 Sherfield Building)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Director of Safety Department</strong></td>
<td></td>
<td>Dr S. Johal</td>
<td>49420</td>
</tr>
<tr>
<td><strong>Deputy Director of Safety Department</strong></td>
<td></td>
<td>Dr A. M de Paiva</td>
<td>49421</td>
</tr>
<tr>
<td><strong>Safety Department Administrator</strong></td>
<td></td>
<td>Mrs S. Kerai</td>
<td>49423</td>
</tr>
</tbody>
</table>

Any changes to this list should be notified immediately to Dr G. D. Fowler.

Email: g.fowler@imperial.ac.uk
FIRST AID TRAINED STAFF CONTACT DETAILS

First Aid

In the event of an accident or medical emergency contact the NEAREST first aider without delay!
Your Nearest First Aiders are:

<table>
<thead>
<tr>
<th>NAME</th>
<th>LOCATION</th>
<th>PHONE</th>
</tr>
</thead>
<tbody>
<tr>
<td>David de Ruyter*</td>
<td>010b</td>
<td>45925</td>
</tr>
<tr>
<td>Fionnuala Ni Dhonnabhain*</td>
<td>118</td>
<td>45929</td>
</tr>
<tr>
<td>Paul Jobson* (Mech Eng workshop)</td>
<td>150</td>
<td>47015</td>
</tr>
<tr>
<td>Stefan Algar*</td>
<td>236</td>
<td>45169</td>
</tr>
<tr>
<td>Gordon Herbert*</td>
<td>236</td>
<td>45948</td>
</tr>
<tr>
<td>Rebecca Naessens*</td>
<td>328</td>
<td>45990</td>
</tr>
<tr>
<td>Tina Mikellides*</td>
<td>401</td>
<td>45965</td>
</tr>
<tr>
<td>Dr Angel Nievas-Pino*</td>
<td>507</td>
<td>45970</td>
</tr>
<tr>
<td>Dr James Lawrence</td>
<td>528A</td>
<td>40700</td>
</tr>
<tr>
<td>Dr Antonio Carb Carraro</td>
<td>528B</td>
<td>46038</td>
</tr>
<tr>
<td>Dr Richard Ghail</td>
<td>534</td>
<td>46001</td>
</tr>
</tbody>
</table>

* Denotes Defibrillator trained

Alexandra Williams - Mental Health First Aider 45995/46153
Lucy Chivers - Mental Health First Aider 46098

If you cannot get hold of a local first aider, contact Security: 4444
Out of normal working hours contact Security: 020 7589 1000

<table>
<thead>
<tr>
<th>Nearest First Aid Box</th>
<th>General Office (118)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nearest AED</td>
<td>SAF Building - Foyer</td>
</tr>
</tbody>
</table>

This notice was last updated: 09/2017
# IMPORTANT SAFETY INDUCTION INFORMATION

<table>
<thead>
<tr>
<th>Evacuation procedure</th>
<th>Evacuate the building on sound of the claxon sounder and evacuation voice and go to the assembly point on the steps of the Queen’s Tower</th>
</tr>
</thead>
<tbody>
<tr>
<td>Campus emergency number</td>
<td>4444 (from an internal telephone) 020 7589 1000 (from all other telephones)</td>
</tr>
<tr>
<td>Frequency of fire drills</td>
<td>Annual (usually during the first 4 weeks of the autumn term)</td>
</tr>
<tr>
<td>Frequency of alarm testing</td>
<td>Weekly at around 8am on Tuesday mornings</td>
</tr>
<tr>
<td>Locations of:</td>
<td></td>
</tr>
<tr>
<td>Fire alarm call points</td>
<td>Five per floor located between each set of fire doors</td>
</tr>
<tr>
<td>Emergency exits</td>
<td>See map in this book</td>
</tr>
<tr>
<td>Evacuation routes</td>
<td>Follow the green arrows located on the back of all office and lecture theatre doors and in the corridors</td>
</tr>
<tr>
<td>Assembly point</td>
<td>On the steps of the Queen’s Tower</td>
</tr>
<tr>
<td>Fire extinguishers etc</td>
<td>Located throughout the building, at least three sets per floor, normally adjacent the emergency exits, plus in all laboratories (look for the Red location signs)</td>
</tr>
<tr>
<td>Safety Notice Board</td>
<td>Located on Level 4 on the wall outside the room 415</td>
</tr>
<tr>
<td>Departmental Safety staff</td>
<td>See the list enclosed in this book and in the lifts</td>
</tr>
<tr>
<td>First Aid Arrangements</td>
<td>See the list enclosed in this book and in the lifts</td>
</tr>
<tr>
<td>Accident reporting</td>
<td>Use SALUS – the online reporting system. This can be accessed from the Safety department web pages on the College intranet: <a href="http://www3.imperial.ac.uk/safety">http://www3.imperial.ac.uk/safety</a></td>
</tr>
<tr>
<td>Safety Department</td>
<td>Provides advice on Safety issues. Located in Sherfield Building, L4.</td>
</tr>
<tr>
<td>Occupational Health</td>
<td>Provides advice and support (including vaccinations and health screening) for all College personnel involved in College work. Located in Sherfield Building, L4.</td>
</tr>
<tr>
<td>Security</td>
<td>Provides a 24 hour, college-wide service relating to building security, first aid and emergency support.</td>
</tr>
<tr>
<td>Web site information</td>
<td>The College intranet contains all the detailed information required to help staff &amp; students understand College policies &amp; procedures.</td>
</tr>
<tr>
<td>Key Web site addresses</td>
<td>Imperial Home Page: <a href="http://www3.imperial.ac.uk/">http://www3.imperial.ac.uk/</a> Use the bookmarks along the top to locate the required Departments and services. For support services (non-academic issues) use the A-Z index under “Admin and Service” to locate the required area.</td>
</tr>
<tr>
<td>Building Access Hours</td>
<td>7am-Midnight every day except Christmas Day and Boxing Day.</td>
</tr>
<tr>
<td><strong>Normal Working Hours</strong></td>
<td>8am-6pm weekdays.</td>
</tr>
<tr>
<td>--------------------------</td>
<td>--------------------</td>
</tr>
<tr>
<td><strong>Departmental Hazards</strong></td>
<td>All department labs are considered to be high hazard areas. Do not enter any laboratories until you have been inducted for the lab and completed a risk assessment for the planned work. The department has a “No Lone Working” policy for laboratories, which applies outside normal hours.</td>
</tr>
<tr>
<td><strong>PPE</strong></td>
<td>All UG MEng students <strong>must</strong> own steel toed and soled safety boots suitable for site work. Other PPE for MEng students is issued in week 1 for use throughout the course. For all other MSc courses, the leaders will advise you regarding the required PPE for each trip.</td>
</tr>
<tr>
<td><strong>Dept. Safety Committee</strong></td>
<td>Meets three times per year to consider all matters relating to Departmental Health and Safety. All Research and Teaching activities are discussed. Student issues are represented by the “Dep Rep”.</td>
</tr>
<tr>
<td><strong>General Advice on Safety</strong></td>
<td>If you have any safety related questions, please contact the DSO: Dr G D Fowler, room 413, ext 45973, email: <a href="mailto:g.fowler@imperial.ac.uk">g.fowler@imperial.ac.uk</a></td>
</tr>
</tbody>
</table>
INTRODUCTION
The Health and Safety of all students whilst studying at Imperial College is a primary concern to the Staff and College. There are several major pieces of legislation that dictate the implementation of Health and Safety Policy and Practise. We must ensure that students are not put at risk during their study at Imperial College. However, there is also a responsibility upon yourself to follow, to the best of your abilities, all instructions and guidance provided. This booklet has been written to provide an outline of Health and Safety arrangements within the Department and to provide you with guidance to your own responsibilities.

GENERAL INFORMATION
Health and Safety within the Department is organised and managed by the Departmental Safety Officer, Dr G. Fowler (room 413, ext. 45973). He is always available to provide advice and guidance on all aspects of Health and Safety. All major Health and Safety decisions are made by the Skempton Building Safety Committee, which meets every term. The committee comprises representatives from all the Sections in the Department, Users of the Building, Student representatives (UG & PG), plus staff with specialist advisory roles for particular activities that may present a risk.

The Orange Health and Safety and Green First Aid/Lifesaver notices provide Health and Safety guidance and list the members of staff with specific safety related duties and responsibilities. Copies of these notices are included inside this book and further copies are spread throughout the Department. These signs are updated regularly. You must yourself familiar with their content.

The College has a significant amount of safety-related information available via its web site: http://www.imperial.ac.uk/safety.

DEPARTMENT SAFETY SHAREPOINT SITE
The Department operates an electronic safety registration and risk assessment system. It is based around an online resource for H+S using the Microsoft SharePoint platform. This system provides a single resource for safety management, including: risk assessment creation and final approval and laboratory safety information. Appendix 1 in this booklet provides a summary of the how you can access the system and complete a risk assessment. As taught students, you will only need to use this system for the research project element of your course where your work include lab or fieldwork activities. Risk assessments will not be needed for desk or computer-based projects. Appropriate training in using this system will be provided when required.
DEPARTMENT SECURITY
Security and safety are closely linked. Please help us keep the building secure and safe by following the following simple rules:

**ALWAYS** wear your College Security/ID card whilst at College. Belt clips or neck lanyards are available from the department General Office.

**DO NOT** allow strangers to enter the building out of hours (deliberately or via tailgating).

**NEVER** lend your ID card to anybody, if they cause damage or present a risk to security or safety, **YOU** will be liable.

DEPARTMENTAL WORKING HOURS
The nature of the College is such that it appears to operate 24 hours per day - research never stops. Nevertheless, there are times of the day which the College considers are "outside normal hours" or access is limited and so special safety procedures including specific risk assessments and or lone working approval may be needed for your work to continue. In addition, there are times of the day when the College is “closed”. The Department open and closed hours are as follows:

<table>
<thead>
<tr>
<th>Category</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal opening hours</td>
<td>8am – 6pm Monday to Friday</td>
</tr>
<tr>
<td>Swipe card access only</td>
<td>7am – 8am and 7pm – 12pm, Weekdays</td>
</tr>
<tr>
<td></td>
<td>7am- 12pm Weekends and Public Holidays</td>
</tr>
<tr>
<td>College “Closed” (swipe inactive)</td>
<td>12pm to 7am every day and during selected days during College Closure at Christmas and Easter</td>
</tr>
</tbody>
</table>

Please make sure that you leave the Department before midnight. College Security patrol the buildings out of hours and any persons found on the premises will be removed from the building and have their access rights curtailed.

SAFE BEHAVIOUR IN THE DEPARTMENT
This is a large and busy building where many varied and potentially dangerous processes occur. You should always be careful when in the building, to ensure that you do not put your self or others in way of harm. For example, be aware of people around you when walking down corridors, so that you do not obstruct them or inadvertently release a door into their path. All doors on the corridors are fire doors and have automatic closer devices fitted which cause the door to swing back, almost instantaneously, to the closed position. Please note that some of these doors (mainly on Level 5) have a delayed close and should not be forced to close – this will damage the closer device. Fire doors must never be propped open with a wedge or other heavy object.
Also, please note:

- Do not run in the corridors.
- The wearing and use of roller blades, inline skates and the use of scooters in the building is forbidden. They are a hazard to other people and damage the floors.
- You must not enter any of the laboratories or workshops without prior permission.
- Bicycles are not allowed in the building – this is a College-wide policy. Bicycles must be stored in the racks provided on Campus.

WASTE DISPOSAL

There are very strict laws governing waste disposal. The College is proactive with regard to waste management and recycling, there are numerous recycling points around the building. Certain wastes generated in the department are separated for recycling/safety reasons. The following is a brief guide to the recycling and waste disposal mechanisms operating throughout the campus and applied within the department.

The College is striving to recycle as much of the waste it generates. One way to achieve this is by segregating waste at source. To achieve this the College has a number of different waste bins in use, which are colour-coded, each one designated for different wastes:

- Waste domestic Glass (not broken glass): Use the red-topped bins
- Paper and Card (no paper cups or food wrappers): Use the blue-topped bins
- Cans and plastic bottles: Use the green-topped bins
- Non-recyclable waste: Use the black-topped bins

Special arrangements exist for non-domestic, electronic and laboratory wastes:
Batteries A dedicated bin for batteries is located on level 2 (BOSS area) in the area near the photocopiers.

Chemical wastes Any waste arising from laboratory activity which is contaminated or classified as hazardous (laboratory staff will advise you if you are unsure) must be disposed of in a controlled manner. Each Laboratory has special containers for segregating these wastes, including solvents, flammable waste, oils, corrosive materials, powders, etc. Please follow the guidance in each laboratory appropriate for the waste requiring disposal.

Clinical waste: Of main concern are syringe needles and any bodily fluids. If you find anything which may fall into this category around the department, please contact the Department Safety Officer (DSO) immediately.

Electrical equipment: Waste electrical equipment must not be disposed of via the non-recyclable waste route. Please contact the DSO for details of the procedures which exist for disposing of these materials.

Laboratory waste Every laboratory has rules regarding the disposal of laboratory waste. You will be advised by laboratory staff what is expected in each laboratory.

Laboratory Glass: The College operates special disposal systems for laboratory glassware which is contaminated or made from Pyrex – it MUST NOT be put into the red recycling bins in communal areas.

Toner cartridges There is a bin on L2 (BOSS area) and L4 outside room 415, dedicated to printer and toner cartridges.

**If you have any doubts regarding the best way to dispose of a laboratory waste, ask the Laboratory staff, your Supervisor or the Department Safety Officer. Your risk assessment should specify all waste disposal procedures required for your work.**
FIRE EQUIPMENT AND ESCAPE ROUTES
The Department has several means of escape in an emergency. The plan below shows the building in relation to the rest of Imperial College.

**Emergency exit locations and Assembly point for Skempton Building**

![Diagram showing emergency exit locations]

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**THERE ARE FOUR PRIMARY EXIT ROUTES FROM THE BUILDING**

- The East Stairs adjacent Mechanical Engineering/Unwin Road
- The West Stairs which are part of Electrical Engineering
- The Main (Central) Stairs beside the lifts, through reception
- Through the BOSS area on Level 2 into the City and Guilds Building

The emergency evacuation assembly point is the stepped area around the base of the Queens Tower

All the corridors in the building must be kept clear. Do not put chairs or tables into corridors, as they reduce the width and cause an obstruction. Similarly, because all the doors in the Department corridors are fire doors, they must NEVER be propped open with wedges, fire extinguishers or by any other means.

You MUST know which way is the quickest emergency escape route from your location in the building. All the emergency escape routes are indicated with an “arrow and running directional figure” green sign. The evacuation alarm is a Claxon sounder with voice instructions. If this activates you must stop what you are doing and leave the building IMMEDIATELY by the nearest emergency escape route in an orderly manner, making sure that you close any doors behind you.

There are evacuation notices in every room in the building (please see the following page for an example) indicating with a green arrow the preferred exit route from that part of the building. Please follow these arrows as they will ensure that you can evacuate from the
building with the minimum of delay. Please try to avoid using the main staircase during an emergency evacuation. The congestion on the main staircase can be significant and your evacuation will be much delayed.

The assembly point is adjacent the base of the Queens Tower

For further details see the Department Safety notices

This notice must NOT be removed from this room
There will be a fire drill during the first term, to familiarise you with emergency procedures.

FIRE PREVENTION & SAFETY

The consequences of a fire in any building can be several fold. Apart from the unacceptable loss of life which may result, there are the lesser consequences of damage to the building, the cessation of activities in the damaged area (or the whole building) and the loss of research and data in an Academic building. None of these outcomes are acceptable.

There is a responsibility upon all users of the building to ensure that fire prevention is a core part of all risk assessments and our day-to-day activities. The College has suffered several fires in recent years. The most serious occurred in the Department of Chemical Engineering and resulted in three laboratories being destroyed. The consequence of the lost research, equipment and data was very costly to the students and staff concerned, irrespective of the fiscal implication for the College and Department.

Current UK Fire Brigade policy is to not place fire fighters at risk, if there are no members of the public (College personnel) in the burning building. Thus, they could allow the building to be destroyed.

There have been several fire incidents in the Skempton Building, mostly caused by faulty electrical equipment. Most recently there was an incident involving the communal Microwave Ovens. When using the microwave ovens, the instructions on the ovens must be followed. **Failure to use the ovens responsibly and safely may result in them being removed.**

**MICROWAVE OVEN SAFE USAGE**

- Follow the instructions on the front of the microwave oven
- Never microwave loose food – always place it in a container
- Only use “microwave oven safe” containers
- Do not use metallic containers or utensils in the microwave
- Loosen/open the lid on the container
- Do not leave food cooking unattended
- If food spills in the microwave, please clean it up.
- Report any problems with the microwave to the Technical Services Manager (b.whiting@ic.ac.uk)

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**IF THE FIRE EVACUATION ALERT SOUNDS, DO NOT:**

- Wait or return to collect any belongings
- Leave the assembly point until instructed to do so
- Return to the building until the all-clear is given
ACCIDENTS AND DANGEROUS OCCURRENCES
The College has a policy that ALL accidents or dangerous occurrences, however small, MUST be reported. This is because there is a very strict law with regard to reporting accidents to the authorities. There is an online system “SALUS” available for reporting all accidents or dangerous occurrences. A dangerous occurrence is an incident that does not result in personal injury.

SALUS is accessible from the Safety department web page via a quick link: http://www.imperial.ac.uk/safety

Typical accidents in the Department tend to occur due to “slips, trips, falls” and poor lifting practice. Many of the corridors in the Department are linoleum or terrazzo. When wet, the floors are slippery. **If you see a wet floor, or cause a floor to become wet**, for example by spilling coffee or tea, please do not walk away, **clear it up with paper towels** (these are available from the General Office).

FIRST AID & LIFESAVERS
The College has a very well organised First Aid system. There are several qualified First Aiders working within the building. The offices of these staff are identified by the Universal first aid sign (a Green & White cross). If you feel unwell or need First Aid assistance please contact any of the staff identified on the list in the front of this book for assistance. In addition, most of the College Security staff are trained in First Aid and can be contacted by calling the College emergency number 4444 or 020 7589 1000. There are supplies of sticking-plasters and bandages available to treat minor injuries (cuts, scrapes and bumps). Any injuries which cannot be readily treated by a First-Aider must be looked at by the Health Centre, who may decide that hospital treatment is necessary.

ELECTRICAL EQUIPMENT
The Department has a **very strict policy regarding mains-powered portable and desk-based electrical equipment** brought onto the premises. This is detailed below. The key aspect of this policy requires that any electrical equipment in the building must be either new or safety tested prior to use. The periodic testing of electrical equipment in the Department is undertaken by external contractors. Thus, unless your electrical equipment meets any of the conditions below, you are **NOT PERMITTED** to plug it into the department electrical 240V sockets.

All equipment which has been tested and passed the electrical safety test will have attached a green sticker indicating that it may be used in the department (see image following). Any equipment not displaying this sticker or meeting the exceptions criteria described below the image, will be confiscated.
New equipment brought into the Department
New equipment brought into the Department may be used for the first year without the need for a Portable Appliance Test (PAT). The user is asked to perform a simple visual check on all equipment prior to use. Records of the equipment purchase, usually through the College finance system or a receipt from the supplier, must be kept to be able to prove the date of purchase. It must also be marked with a European CE mark or an otherwise equivalent international directive.

Personal electrical equipment brought into the Department
Personal electrical equipment brought into the Department will be PAT tested as Departmental equipment. To ensure that personal electrical equipment is tested within an acceptable timeframe (limit of one year of safe usage), only new personal equipment may be brought into the Department. Proof of date of purchase will be required. Under no circumstances may old equipment be brought into the Department. If old equipment is found then it will be confiscated and may be destroyed. The exception to the above is personal mains chargers for devices such as laptops, tablets and phones, etc. for which there is no age restriction.

Unauthorised electrical equipment
The list below gives some examples of unauthorised electrical equipment which must not be brought into the Department:

- Electric fires and heaters of any form
- Any form of equipment used for cooking or warming food (kettles, toasters etc.)
- International equipment which is not compatible with the UK mains voltage (220-240V)
- International equipment which is not marked with either the European CE mark or an equivalent international standard.

**Electrical equipment belonging to visitors**
Electrical equipment belonging to visitors and brought into the Department will be subjected to the normal Departmental rules.

**Electrical equipment belonging to third parties**
Electrical equipment belonging to third parties, such as contractors working within the Department, are the responsibility of the third party who will be required to demonstrate that their policies and procedure are at least in accordance with and of a standard compatible to those of the Department.

**Design, construction, checking and testing of electrical equipment**
Those involved in the design and construction of electrical equipment will be required to ensure that such equipment is suitably tested to ensure that it performs within the general conditions of the Department’s “Electrical Equipment – Policy and Code of Practice”.

**Repair, installation or modification of electrical equipment**
Unless otherwise directed, staff and students in the Department are not allowed to undertake any repair, installation or modification to electrical equipment.

**Disposal of electrical and electronic equipment**
Consult the Facilities Management web pages to arrange for the collection and disposal of unwanted College Equipment (there may be a charge for this service).


**LABORATORY COURSES**
There may be several occasions when you will undertake laboratory work as part of your course. The Department is very unusual within the College in that it operates all major classes of laboratories with many diverse activities, which include the traditional mechanical and engineering testing through to specialised chemical and biological work. Each laboratory has their own specific safety procedures which will be explained in detail before any work commences, you MUST abide by the following general rules for any laboratory behaviour/work.
Work in any laboratory must only be conducted during normal College hours (9am-6pm), with at least one other person in sight at all times. Lone laboratory working is **NEVER PERMITTED**. Additionally, the other person in the laboratory must know the College emergency procedures and be familiar with the working environment so that if they need to isolate a service or make safe an experiment in an emergency, they know what to do.

### RISK ASSESSMENTS

Risk assessment is the cornerstone of Health and Safety management. No activity should be started before a risk assessment has been completed. To be able to perform a risk assessment you need to know what you are going to do and have an understanding of the steps and processes required in the task being assessed. If all the information is at hand, the assessment should be a straightforward task. If the risks are considered to be too high, this does not mean that the activity cannot be completed but it may mean that a different approach or better control measures are required to reduce the potential risks.

For most laboratory classes, the assessment will have been undertaken by the course or laboratory organiser. They will explain the assessment to you and indicate the main risks from the work to be conducted and advise you how to avoid these risks. However, some laboratory or fieldwork classes will require you to complete your own assessment (particularly for project work). The Department has standard online forms for this purpose, accessed via the SharePoint site mentioned earlier. Guidance on the completion of these forms will be provided in special introductory sessions prior to you undertaking the projects requiring assessments.

When completing risk assessments, if you need further information or require advice, you must ask the staff supporting your work (Academic or Technical). If they cannot provide the necessary answer or information, please do not hesitate to ask the DSO.

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**Laboratory “Do and Do not”**

**DO**

- Follow all instructions from the demonstrators/lab staff
- Wear all necessary personal protective equipment, especially your safety glasses, at all times in all laboratories
- Tie back long hair
- Wear appropriate clothing and stout shoes or safety boots, as required.

**DO NOT**

- Wear long/dangly clothing or jewellery which may become snagged in moving machinery
- Wear sandals or open-toed shoes
- Run or fool about in the laboratories
- Eat or drink in ANY laboratory
FIELD COURSES

During the time of your studies within the Department of Civil and Environmental Engineering, there are several major courses of varying duration that require you leave the Department and College premises. Whilst away from these premises your Health and Safety is still our responsibility. We take this responsibility very seriously. The College is covered for most events by its insurance, but there is an important onus (and a legal responsibility) upon you to abide by College Health and Safety rules. Every field course has its own specific set of instructions which detail the risks and methods for minimising these. Copies of these instructions will be given to you prior to your undertaking of the course. The following information is meant as a general benchmark for you to use and apply at all times when away for course purposes.

When we organise any field course, the course co-ordinator carefully considers all the potential risks that may occur and are attributable to the particular situation. For example a visit to a quarry has particular dangers which are different to a visit to a bridge or road, but there are several common risks which can be controlled and minimised if not entirely eliminated by applying several basic rules.

1. Whilst on any field course, the most important rule is that you MUST follow the instructions of the course leader. Pay particular attention to guidance on safe practices whilst on that trip.
2. Do not try to take too much luggage with you, heavy bags can be difficult to carry and cause back strain, as well as being a potential danger if they fall from luggage racks in buses.
3. Ensure that you are suitably dressed for the trip or course i.e.: a hard hat, warm and waterproof clothing and stout shoes would be a minimum requirement for a winter visit to a site – forget fashion!
4. Take particular care when crossing roads checking in both directions for traffic before crossing. When walking alongside roads not designed for pedestrians try to stay at least 1m from the traffic at all times.
5. Make sure that you inform the course leader of any medication which you use or any ailment which you suffer from that may be a problem during the course. For example if you are a diabetic or have food allergies, it is vital that the course leader of a residential trip is aware of this in advance for dietary purposes or in case you require medical assistance on the course. Ensure that you are carrying sufficient medication for the duration of your course. A less obvious condition, but equally dangerous would be if you suffer from vertigo and visits to a bridge or tall building may be a problem or conversely, claustrophobia would be an issue for a visit to sewers.
6. Be aware of problems like dehydration and sunburn which may occur on summer field trips.
7. Any accident or dangerous occurrence, however minor, must be reported immediately to the course leader.
8. The evenings of residential courses may seem like a ideal opportunity to relax and have fun, but alcohol abuse can be dangerous and antisocial behaviour resulting from this will NOT BE tolerated.
9. You are representing Imperial College whilst on the course. Any public nuisance or criminal prosecution resulting from disreputable behaviour whilst on the course will be your liability and not the College’s. For example, some sites are classified as SSI’s (Special Scientific Interest), damaging them by even walking across them can result in prosecution.
10. Visits to sewers, building sites or other outdoor environments may expose you to pathogens such as Tetanus or Leptospirosis (Weils Disease). It is recommended that your tetanus jab is kept up to date. It is usually valid for 10 years. The course leader or coordinator must provide you with course details and risk assessments before commencing the field work activity. If you do not receive this information, ask the coordinator for it. **MEng Students must take the supplied PPE on all the field courses.** Failure to do this will result in you being refused participation in the course which may mean you fail that element and hence the year.

**Visits Abroad**

Trips outside the UK are a feature of some of the courses. However, depending on the reason for your trip abroad, the College’s insurance may not provide full cover in all eventualities (i.e. terrorism and war zones). There may be particular risks which must be considered alongside the normal risks discussed above.

The most obvious hazards are from disease, both insect and water-borne, which will generally be regional specific i.e. tropical climates – Malaria, so advice on the require vaccinations will be needed. The availability of clean drinking water cannot be overlooked.

There may also be hazards due to wildlife, for example, predators such as large cats, venomous creatures (snakes, spiders, fish etc.), sharks, polar bears and so forth.

Despite the growth of global communications, some parts of the world do not have very comprehensive satellite or mobile phone coverage, so communications with other part of the country or globe may be limited. In addition, battery life on mobile telephones must be carefully managed as you cannot guarantee to be able to find a suitable electrical supply to boost your telephone’s charge.

A further factor to consider is the political stability of the country you will be visiting. The risk of kidnap is a real threat in some countries. It is advisable to register with your national Embassy when you arrive in a foreign country, so that they know you are there. There are some countries around the world where organised society has broken down or is badly eroded due to Civil war or natural disasters. There must be very compelling reasons to travel to countries with these particular problems and comprehensive risk assessments will be required. In addition, approval for trip to countries which fall into this category will need to be given by the Head of Department. Your supervisor or course leader should make all the necessary arrangements to cover your trip. This includes activating the College insurance, which is a comprehensive policy. Nevertheless, it is very important to recognise that **no travel insurance** is truly and fully comprehensive. There are limits to what an insurance company can do to recover you from danger or protect you from harm. [International Rescue (“Thunderbirds”) do not exist].

There are several sources of information relevant to trips abroad:

The UK Foreign and Commonwealth Office web pages contain all the information to help make your trips as safe and enjoyable as possible: [http://www.fco.gov.uk/](http://www.fco.gov.uk/). Follow the links for “travel advice”.

If you need to undertake international trips for projects etc., please plan ahead. Discuss the project needs with your supervisors and the DSO, as required and submit the risk assessment form at least three weeks before you intend to travel.

College Occupational Health will provide advice on travel medication, injections etc., and will also undertake immunisation injections for College-required trips. However, you must arrange these well in advance of your trip (ideally, at least one month before travel).

PERSONAL PROTECTIVE EQUIPMENT
Personal Protective Equipment, (PPE) is an essential part of Civil Engineering site safety. In recognition of this PPE is an essential requirement for the field courses run by the department.

All first year undergraduate (MEng) students will be issued with a personal safety pack after Christmas, just prior to the commencement of their first fieldtrip. This safety equipment must be kept safe and looked after because the items will be needed throughout the four year MEng degree. If you lose any items you will be charged for replacements. If you do not bring them to your course when required, you will not be permitted to undertake the module and may fail the course as a result.

The safety pack will comprise the following items:

- Hard Hat
- Safety Glasses
- Site Gloves
- High-Vis Vest

**Hard Hat**
British Standard Hard Hats must be thrown away after four years, as their safety performance cannot be guaranteed after this time. MSc students will be issued with hard hats during field courses and other times as required, but these must be returned to the Department. The Department issues Hard Hats as part of the safety pack above for all undergraduate students in the Department. The Hats will be needed for most field courses over the 4 year course and must be looked after.

**Safety Glasses**
MSc students will be issued with safety glasses as required for laboratory and field courses. These are issued as part of the safety pack to the undergraduate students. Safety Glasses are required for all laboratory courses and most field courses. If you do not have a pair of safety glasses, you will be unable undertake the course.

**IMPORTANT**
The College Insurance Policy is NOT VALID if you take personal holiday whilst away for College purposes. YOU MUST ensure that you have separate, personal travel insurance for recreational activities, holidays and non-College related travel whilst away.
**Gloves**
Increasing concerns over dermatitis (from cement) and cuts and grazes from construction site activity has seen the compulsory wearing of gloves on all construction sites. A pair of cotton gloves suitable for site are included in the safety pack issued to the undergraduate students and these are needed for all site visits. MSc Students will be issued with a suitable type of glove for laboratory and fieldwork courses.

**High-Vis Vests**
Site visibility is a key part of safety management, hence all site visits require the wearing of high-vis vests or jackets. A high-vis jacket forms part of the Safety Pack, for UG students, whilst MSc students will be issued with them as required.

**Safety Boots**
All undergraduates and some MSc students (Check your course information) must own a pair of safety boots. The footwear needs to be classified as complying with EN ISO 20345, which provides the highest level of impact resistance in the toe area and be fitted with a steel mid-sole with steel toe caps and offer ankle support.

Not only are safety boots essential for any visits to construction sites, but some laboratories within the Department require that they be worn at all times and they are needed for the Surveying, Geology and Constructionarium field trips during the first and second years of the MEng degree respectively.

The Department will be arranging for a specialist supplier to attend the Skempton Building during the first week of term to sell these boots (check your course information for more details). The wearing of safety boots is compulsory during certain courses and failure to abide by this rule will result in you being barred from the course and possibly failing that module (and hence the year). Safety boots can be readily purchased from many high-street suppliers, but these must meet the minimum requirement described above.

Some MSc courses will issue the safety equipment as the class need arises, but this must be returned to the Department at the end of the class.

**WEB RESOURCES FOR HEALTH AND SAFETY AT THE COLLEGE**

The College Intranet, which is accessible for all College networked PC’s, has comprehensive health and safety information covering most aspects of the activities undertaken by the College. This information can be readily accessed from either the Safety Department or the Occupational Health web pages, which can be reached under the “A-Z” tab (admin and Services) on the right-hand side of the College main menu bar of the Home Page.

Some of this information is protected and you will need your College username and system password to view all the information contained within. You can access SALUS for reporting accidents and dangerous occurrences (as described above) from this site, plus view the College policy on health and safety and guidance on many aspects of safety.
COMPUTER USE

The Department is particularly well equipped with open access computing laboratories on levels 2 and 3 that are used for teaching as well as research purposes. However, it is becoming increasingly common for people who use computers or “display screen equipment” (DSE) for long hours to start to suffer from eye and skeletal/musculature problems, particularly if you use a laptop rather than a “fixed” desk computer. This may result in eye strain, back, neck and shoulder pain, problems with wrist and arm joints. The College has produced detailed guidance on ways of minimising/eliminating potential problems from DSE use. A copy of this information sheet is appended to this booklet. Please read and apply this information, it may save you much discomfort later in life.

If you undertake a project which involves long hours of computer use then you should follow the guidance below and undertake a DSE assessment of the workstation you are using. The “Computer Health & Safety Checklist” (DSE assessment) form is available to download from the following link:

http://www3.imperial.ac.uk/OCCHALTH/formsandchecklists

Computer Use – Healthy Working

All members of the college community use computers to a greater or lesser extent. You should undertake a simple DSE assessment of the workstation you are using.

It is becoming increasingly common for people who use computers or “display screen equipment” (DSE) for long hours to start to suffer from eye and skeletal/musculature problems, particularly if you use a laptop rather than a “fixed” desk computer. This may result in eye strain, back, neck and shoulder pain, problems with wrist and arm joints. This is called “Cumulative Trauma Disorder”. The set-up of your computer workstation is very important. A poor set-up may cause the above health issues. If you start to suffer from any of the above symptoms from using computers, you must contact the departmental Display Screen Assessor (Dr Fowler) for any questions or concerns you have with regard to healthy computer usage.

The following guidance will help you in minimising the likelihood of the symptoms developing indicative of Cumulative Trauma Disorder.

Staying Healthy With Your Computer

Avoiding Cumulative Trauma Disorder

Computers can damage your health. Every year we see several cases of Cumulative Trauma Disorder (CTD) formerly called RSI or Repetition Strain Injury in staff and students and the problem is becoming more common. Avoid it happening to you by taking care to organise your work-station and organise your time spent using a computer both at work and at home.

Follow these simple rules and find that your computer can work for you without causing harm.
Take Breaks - The Key Issues
1. Intersperse with other work (take note laptop users!): phone calls, writing/reading work, filing, proof reading, photocopying, talking with colleagues. Even coffee breaks!
2. Five minute break every hour and don’t spend a whole day on computer-based activities (applies equally to work at home). Web surfing, updating Facebook, Blogging or online gaming do not count as a break!

Keep Your Desk Tidy
Avoid cluttering it up with books, papers etc. Make sure you have enough clear space to operate your mouse easily and to access your keyboard. Keep most frequently used items close to hand to avoid stretching.

Adjust Your Computing Equipment to Suit You
1. Set your screen to a comfortable height, usually with the top just below eye level, so you do not have to stretch your neck. Avoiding any twist in your spine, sit face-on to your screen.
2. Ensure sufficient room to rest your hands in front of keyboard when not keying. Interchange position of keyboard and mouse depending on data input device predominantly in use at the time.
3. Adjust your seat height so your arms are horizontal to the keyboard and avoid flexing/extending wrists. If you use a laptop, work with it on a table, never on your lap.
4. Ensure room for your feet to rest under your desk. A footrest may be beneficial for small people.

Get Comfortable

| Make use of the illustrations below to see whether you’ve organised your desk and your work to avoid unnecessary problems. *The rules for desktop users apply to work with laptops; whenever possible the same advice should be followed.* |

*Don’t ruin your work by poor practice. Be organised, be sensible with your work-time & be successful— without damaging your health.*
1. Adjust the seat height and back tilt/height to fit you. Twisted or cramped posture to be avoided.
2. If you are copying documents, use a document holder.
3. Sit back when you are thinking, rather than staying hunched over your screen.
4. Use a soft touch when keying and avoid flexing your wrists. Try to adopt a neutral position. If possible, learn how to use short cut keys and touch typing.
5. Give your eyes a comfort break too. Look away from your screen or close your eyes when thinking. Avoid staring at the screen and throw in a few extra blinks as natural blink reflexes are often unconsciously suppressed.

DON'T IGNORE SYMPTOMS
If your arms or shoulders start aching/tingling, follow steps below.

1. Take a break and re-organise work to give yourself more breaks in future.
2. If symptoms persist or keep recurring, contact your occupational health (OH) service for help.

Make Use of the Experts
1. All College departments should have a DSE (Display Screen Equipment) Assessor who knows about computer ergonomics and can help you check your workstation. They'll help you with the computer checklist if you don’t feel confident to complete it yourself. Also if you identify problems through the checklist which you can’t solve yourself or which may affect your or other’s safety.
2. Your local OH service can assess and advise on CTD problems.
3. Students can arrange vision screening with the OH service.

**Personal Safety for Laptop Users**

1. Do not endanger your health by carrying too heavy a total load with the addition of your laptop.
2. Take precautions to avoid theft while your laptop is in transit and check your insurance cover. Your personal safety is more important than loss of your laptop.

Dr G. D. Fowler
Departmental Safety Officer
August 2017
Appendix 1: A quick guide to using the Department SharePoint Safety Site

Imperial College
London

An Introduction to using the SharePoint Site

Dr Geoff Fowler
Departmental Safety Officer
Risk Assessments

- All research activities undertaken in the College MUST have a risk assessment.
- Risk assessments MUST be done BEFORE the work starts.
- All the necessary forms and processes are available via a SharePoint system.
- Academic Supervisors must approve the assessment and electronically sign it off.
- Secondary Checker also approves (Lab manager or DSO)

The SharePoint Site

- An automated system to the enable the creation of risk assessments and manage their approval and archiving

- Accessible from any Networked PC or VPN connection – use College ID and Logon

- Works with most internet browsers. It does not work in Linux
The SharePoint site allows you to attach extra information linked to your General Risk Assessment:

- COSHH Assessment
- Computer use (DSE)
- Fieldwork Risk Assessment
- These separate Word forms are all on Blackboard & SharePoint for download

Risk Assessment – A Step-by-Step guide

- Log onto SharePoint:
  https://imperiallondon.sharepoint.com/sites/foe/CivilEng/HealthandSafety/default.aspx
  
  - The Microsoft SharePoint logon page may open first, asking for your College username (“USERNAME@ic.ac.uk”). Enter your details and then you will be transferred to the Imperial College SharePoint logon page. Enter your College Password and then:
  
  - The Department H&S SharePoint site will open

*Use Explorer v10, Firefox or Chrome. It does not work in Linux or Explorer v11*
Logging on to SharePoint – Initial 365 sign in

Enter your College username. Use "@ic.ac.uk" as the address identifier. The site will automatically forward you to the Imperial College SharePoint Office 365 (cloud-based) main login page.

Logging into SharePoint – Imperial 365 site

Enter your College password. Then click the "sign in" button. The department Health and Safety site should open.
Using the Site

• 1\textsuperscript{st} step: Complete a General Risk assessment:
  - This covers many activities, but occasionally you will need to use special forms for certain tasks (COSHH, Fieldwork, Biological work)
  - You need to identify all the risks and quantify them
  - Attach extra information including Engineering/experimental designs, SOPs etc.

• 2\textsuperscript{nd} Step: submit your form(s) for approval:
  - Approvers may include: Your Supervisor, the Laboratory Manager, A qualified 2\textsuperscript{nd} engineering academic (for Structures), the HoD (for hazardous fieldwork) & the DSO.

• 3\textsuperscript{rd} Step: Forms are assessed and approved (or rejected) by your Supervisor & Lab Manager
SharePoint General Risk Assessment
How to complete the form (1)
Starting the form & selecting the assessors

Enter all requested information. Blank spaces or unanswered questions will prevent the form from being submitted for approval.

Your name
Your Supervisor
Lab Manager or DSO

Ticking this box allows for an extra assessor to be included (useful for complex assessments, hazardous fieldwork where a Specialist assessment is required e.g. HiQ etc.)

Enter the title of the project and put your initials (in brackets) at the end to create a unique file reference. This entry becomes the file name.

Provide a brief description of the planned work. Enough detail for the reviewers to know what the project is about, but do not provide details on methods or risks. Attach method files, CoshH assessment etc. & complete the risk matrix below.

SharePoint General Risk Assessment
How to complete the form (2)
Lone Working & Hazard identification

Lone working is a significant issue of concern for the College. This section must be completed accurately & honestly.

Use these options to help identify hazards. Ticking a box opens a guidance section with links to a specific specialist risk assessment forms. The specialist forms (CoshH, Fieldwork etc.) must be completed too and attached to this form for submission and approval as part of this risk assessment process.

Complete all the sections. Any unanswered parts will prevent submission of the form.

Read the guidance & advice to understand what is needed here.
SharePoint General Risk Assessment
How to complete the form (3)
Risk assessment

- Raw risk: Probability is always 4
- Severity is selectable (1-4)
- Use the help box to understand what severity and probability mean and the difference between each numerical value (1-4).
- Identify each hazard on a separate line (lines can be added using the "insert another hazard box")
- Attach all supporting documents here. These can include COSHH forms, Fieldwork Forms, method descriptions, Bio1 approval forms, experiment design notes and other supporting documents.

- Residual risk: Probability should have reduced
- Severity is unlikely to change
- Do not leave an empty line in this table – it will prevent the form from being submitted

SharePoint General Risk Assessment
How to complete the form (4).
Completion and Submission

- Answer all these questions. Use the risk analysis outputs to ensure that you do not overlook any required measures.
- Select a review period longer than the planned length of the project. If the assessment is for a 3 month MSc project, pick at least 6 months as the review period etc.
- You do not need to complete the form in a "single sitting". You can save the form at any time and return to it later

- Additional Safety Control Measures
- Emergency Procedures
- Review of the Risk Assessment

- This box will remain unavailable until you have completed all the required sections/boxes.
- Once you have completed the form and are happy with the content, you should submit it and await the assessors’ opinion. Hopefully, they will approve it. If they do not, you should receive feedback on the rejection email stating what improvements are required. You will need to make the changes and resubmit the form.
- You CANNOT start work until the form has been approved.
The SharePoint site allows you to attach extra information linked to your General Risk Assessment:

- **COSHH Assessment (Dept specific form)**
  - Legally required for any work involving harmful substances: Acids, glues, gases, solder, flux, dyes, etc.

- **BIO1 form**
  - College requirement for any work involving biological agents. Any Biological work MUST be discussed with the DSO before you do any preparation work.

- **Fieldwork Risk Assessment (FW1)**

- Each of these forms are separate WORD documents available through SharePoint

**5 Steps for undertaking a risk assessment**

- **Step 1:** Identify the hazards
- **Step 2:** Decide who might be harmed and how
- **Step 3:** Evaluate the risks and decide on precautions
- **Step 4:** Record your findings and implement them
- **Step 5:** Review your assessment and update if necessary
Hazard & Risk Defined

• HAZARD: anything that may cause harm, such as chemicals, electricity, working from ladders, an open drawer etc;

• RISK: the chance, high or low, that somebody could be harmed by these and other hazards, together with an indication of how serious the harm could be.

Lone Working

• There must be at least one other person in a laboratory with you outside of normal hours.

• That person must know what to do in an emergency (A “BUDDY”).
  – How to stop the experiment
  – Emergency procedures
  – Who to call

• The best way to avoid lone working concerns is to plan your work
Research Specific Training

- It is **essential** that you know how to perform your research competently and safely.
- You are **forbidden** to use any item of Laboratory equipment or undertake a procedure until you have been appropriately trained.
- If you have any doubts or concerns about the equipment or methods, even after training, then you must ask for more instruction.
- Failure to do this may result in harm to you, your colleagues and/or the equipment.
- This may result in prosecution of the College, your Supervisor and you.

FINALLY…

- If in doubt about any safety issue, ALWAYS ask somebody:
  1. Your Supervisor
  2. Laboratory Staff
  3. Department Safety Officer
If you have any questions about using the SharePoint Site, need assistance to complete a risk assessment or have any other safety-related questions, please contact the department Safety Officer:

Dr Geoff Fowler
Room 413
g.fowler@ic.ac.uk
CI9-EE-01 Advanced Water and Wastewater Treatment

Course leader: Professor Nigel Graham
Other contributors: Dr Michael Templeton, Professor Stephen Smith, invited speakers
Module status: Core H2UM
Pre- or co-requisites: CI9-EE-28 (co-requisite)
Term: Spring
Contact hours: 18
ECTS units: 3
FHEQ Level: 7
Assessment: Written examination

1.0 Aims

- To extend and deepen the scope of the introductory module on drinking water, and wastewater treatment (CI9-EE-28).
- To cover the background to water quality, standards and regulations, and more specialised unit processes of softening, ion exchange, oxidation, adsorption, and membrane systems.
- To review the fundamental basis of aerobic treatment processes, and describe methods of advanced effluent treatment for higher discharge standards and effluent re-use.

2.0 Syllabus

<table>
<thead>
<tr>
<th>Week No.</th>
<th>Topic</th>
<th>Staff</th>
</tr>
</thead>
<tbody>
<tr>
<td>16</td>
<td>Drinking water quality standards</td>
<td>Professor N. Graham</td>
</tr>
<tr>
<td>17</td>
<td>Preliminary and primary processes</td>
<td>Dr M. Templeton</td>
</tr>
<tr>
<td>18</td>
<td>Softening and ion exchange</td>
<td>Professor N. Graham</td>
</tr>
<tr>
<td>19</td>
<td>Kinetic theory</td>
<td>Dr M. Templeton</td>
</tr>
<tr>
<td>20</td>
<td>Oxidation and adsorption</td>
<td>Professor N. Graham</td>
</tr>
<tr>
<td>21</td>
<td>Activated sludge II</td>
<td>Dr M. Templeton</td>
</tr>
<tr>
<td>22</td>
<td>Membrane technology</td>
<td>Professor N. Graham</td>
</tr>
<tr>
<td>23</td>
<td>Tertiary treatment</td>
<td>Dr M. Templeton</td>
</tr>
<tr>
<td>24</td>
<td>Sludge disposal practice and policy</td>
<td>Professor S. R. Smith</td>
</tr>
</tbody>
</table>

- Drinking water treatment: water quality standards, and regulations; mixing and flocculation; softening and ion exchange; oxidation and adsorption; membrane processes.
- Wastewater treatment: preliminary and primary processes; kinetic theory; activated sludge systems; tertiary treatment; sludge disposal practice and policy.
- Discussion of the basis of present day sewage sludge disposal practice and policy.
3.0 Intended learning outcomes

On successfully completing this course unit, students will be able to:

- Appreciate how the nature of source waters and raw wastewaters, and treatment objectives, influence the type, number and sequence of unit processes.
- Understand the fundamental, scientific basis governing the design and performance of the treatment technologies reviewed in the module.
- Understand the role of each unit process within typical treatment process trains, their interaction and the context of when they are applied.
- Appreciate the advantages, disadvantages and limitations of the technologies and new developments.
- Be able to define an appropriate process stream for the treatment of a typical raw/source water and a wastewater, and the main secondary flows from the treatment.
- Apply their knowledge of the principles of water and wastewater treatment to the design of each unit process reviewed in the module.
- Be familiar with the terminology applied to water and wastewater treatment processes and the key design parameters, units and common figures of merit.

4.0 Teaching methods

A combination of lectures and tutorials. The module is delivered in the spring term as a set of 18 lectures and includes a number of invited speakers and tutorial exercises. The content of the module is complemented by site visits to treatment plants during the study tour at the end of the term.

5.0 Assessment

Assessment is by examination only.

6.0 Recommended textbooks

Category as defined by Central Library:

C = Core, S = Supplementary

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<table>
<thead>
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<tbody>
<tr>
<td>S</td>
<td>Chemistry for Environmental Engineering and Science</td>
</tr>
<tr>
<td>S</td>
<td>Water Supply</td>
</tr>
<tr>
<td>S</td>
<td>Basic water treatment</td>
</tr>
<tr>
<td>S</td>
<td>Fundamentals of Water Treatment Unit Processes</td>
</tr>
<tr>
<td>S</td>
<td>Water Supply and Pollution Control</td>
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</table>

Module Descriptor 2017-18
Revised: 26-Jul-2017
### 7.0 Subject threads

The table below shows how the themes of design, sustainability and health & safety risk management are embedded in the curriculum (as defined by the JBM degree guidelines).

Key: Primary (P), Secondary (S) and Contributory (C).

<table>
<thead>
<tr>
<th>Design</th>
<th>Health &amp; Safety Risk Management</th>
<th>Sustainability</th>
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<tbody>
<tr>
<td>S</td>
<td>-</td>
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</tbody>
</table>
CI9-EE-02 Air Pollution Control

List of contributors:
- Professor Chris Cheeseman
- Dr Audrey de Nazelle (Centre for Environmental Policy)
- Professor Stephen Smith
- Ian Cranshaw (MWH)

Module status:
- Core H2UM

Prerequisites:
- Pre- or co-requisites: H2UM

Contact hours:
- 8

ECTS units:
- 1.5

FHEQ Level:
- 7

Assessment:
- Written examination

Aims
- To provide students with a solid introduction to the key issues associated with air pollution, policies and standards, monitoring and modelling, air pollution chemistry and issues associated with bio-aerosols. The module also includes key aspects associated with odour control technologies.

Syllabus

<table>
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</thead>
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<tr>
<td>21</td>
<td>Air pollution monitoring and modelling</td>
<td>Dr A. de Nazelle</td>
</tr>
<tr>
<td>22</td>
<td>Control of Bio-aerosols</td>
<td>Professor S. R. Smith</td>
</tr>
<tr>
<td>23</td>
<td>Air pollution impacts on health in developing countries</td>
<td>Dr A. de Nazelle</td>
</tr>
<tr>
<td>24</td>
<td>Odour control</td>
<td>Ian Cranshaw</td>
</tr>
</tbody>
</table>

Intended learning outcomes

- Have a good understanding of key aspects associated with air pollution and the problems this causes.

Teaching methods

- The module consists of four two-hour lectures.

Assessment

- Assessment for this module is by examination only.
6.0  Recommended textbooks

Category as defined by Central Library:

C = Core, S = Supplementary

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CI9-EE-03 Chemistry for Environmental Engineers

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<tr>
<th>Course leader:</th>
<th>Professor Sue Grimes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Other contributors:</td>
<td>Dr Geoff Fowler</td>
</tr>
<tr>
<td>Module status:</td>
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<tr>
<td>Pre- or co-requisites:</td>
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<td>Term:</td>
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<tr>
<td>FHEQ Level:</td>
<td>7</td>
</tr>
<tr>
<td>Assessment:</td>
<td>Written examination</td>
</tr>
</tbody>
</table>

1.0 Aims

- To provide an introductory course in chemistry for environmental engineers, which assumes little prior knowledge of the subject, and, in particular, to develop a basic knowledge of the underlying principles of chemistry that influence environmental processes such as water and wastewater treatment, air pollution control and waste management.

2.0 Syllabus

The syllabus will include topics in:

- Fundamental concepts in chemistry: Structure of atoms, elements and molecules; bonding; chemical equations; chemical reactions.
- Chemistry of water: Physical and chemical properties of water; water and the environment; behaviour of water in the environment; water as a solvent for gases and solids; water as a reaction medium; water as a transport medium.
- Organic chemistry: Structures, properties, bonding and reactions of carbon compounds; Significance of organic molecules and their interaction with environmental media; importance of functional groups in contamination and pollution.
- Biological chemistry: Functional groups, bonding and reactions of molecules of importance in living organisms.
- Analytical chemistry: Important techniques in analytical chemistry; data collection – units and quantities, data quality, and data interpretation.
### 3.0 Intended learning outcomes

On successfully completing this course unit, students will be able to:

- Understand the fundamentals of environmental chemistry (inorganic, organic and physical in terms of the structure of matter, bonding and chemical reactivity).
- Understand the origins, transport, reactions and fates of chemical species in water, air, land and living environments.
- Learn from specific examples of the interactions of chemicals and environmental media.
- Appreciate the relevance of chemicals to environmental pollution, hazardous properties of materials, and waste and wastewater treatment.
- Understand the importance of chemical analysis in environmental science including techniques, units and quantities, instrumentation, data quality and data interpretation.
- Apply their knowledge of the principles of chemistry in the context of environmental engineering problems for example in the provision of safe, potable and ample public water supplies, the treatment of wastewater and solid wastes, and the control of water, soil and atmospheric pollution.
- Use their knowledge of the relevance of high quality statistically accurate analytical data to guide decision-making on environmental solutions in field situations.
- Transfer their knowledge and skills to environmental engineering situations to ensure best practice outcomes designed to minimise environmental impacts.

### 4.0 Teaching methods

The course content is delivered through a suite of nine 2-hour lecture. Tutorial questions and answers are provided on BBL for self-learning.

### 5.0 Assessment

Assessment of the module is by examination only.
6.0  Recommended textbooks

Category as defined by Central Library:

C = Core, S = Supplementary

| S | Chemistry for Environmental Engineers |
| S | Environmental Chemistry |
| S | Chemistry - General, Organic and Biological |
|   | Amend J.R, Mundy B.P. & Arnold M.T. Saunders College Publishing |
| S | Chemistry for Today: General, Organic and Biochemistry |
|   | Seager, S.L. & Slabaugh, M.R |
| S | Exploring Chemical Analysis |
|   | Harris, Daniel C. 4th Edition |
| S | Quantitative Chemical Analysis |
|   | Harris, D.C. 8th Edition |

7.0  Subject threads

The table below shows how the themes of design, sustainability and health & safety risk management are embedded in the curriculum (as defined by the JBM degree guidelines).

Key: Primary (P), Secondary (S) and Contributory (C).

<table>
<thead>
<tr>
<th>Design</th>
<th>Health &amp; Safety Risk Management</th>
<th>Sustainability</th>
</tr>
</thead>
<tbody>
<tr>
<td>-</td>
<td>S</td>
<td>C</td>
</tr>
</tbody>
</table>
CI9-EE-04 Contaminated Land & Groundwater (CI9-GEO-34)

Course leader: Dr Adrian Butler
Other contributors: Mr Adrian Shields, Dr Hugh Potter, Mr Matthew Pearce
Module status: Core H2UM, H2UP, H2UN
Pre- or co-requisites: 
Term: Spring
Contact hours: 18
ECTS units: 3
FHEQ Level: 7
Assessment: Written examination

1.0 Aims

- Understand the problems associated with contaminated land that have arisen from the unmanaged release of pollutants into the environment.
- Gain a detailed understanding of the physical processes governing the fate and transport of organic and inorganic pollutants in the subsurface, and how these can be represented using mathematical models.
- Learn methods for good practice in data collection for site characterisation.
- Develop remediation options through risk assessment techniques in order to ensure a rational approach to site assessment and clean up, subject to environmental and economic constraints.

2.0 Syllabus

- Students undertaking the course are assumed to be familiar with the basics of hydrogeology, particularly groundwater flow (incl. head, Darcy’s law, permeability, hydraulic conductivity, transmissivity, groundwater monitoring and interpretation of head data).

<table>
<thead>
<tr>
<th>Week No.</th>
<th>Topic</th>
<th>Staff</th>
</tr>
</thead>
<tbody>
<tr>
<td>16</td>
<td>Introduction/Regulatory Context</td>
<td>Dr A. Butler</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Dr Hugh Potter</td>
</tr>
<tr>
<td>17</td>
<td>Mass Transport I (aqueous phase)</td>
<td>Dr A. Butler</td>
</tr>
<tr>
<td>18</td>
<td>Mass Transport II (multiphase)</td>
<td>Dr A. Butler</td>
</tr>
<tr>
<td>19</td>
<td>Risk Assessment</td>
<td>Dr A. Butler</td>
</tr>
<tr>
<td>20</td>
<td>Site Evaluation</td>
<td>Adrian Shields</td>
</tr>
<tr>
<td>21</td>
<td>Site Remediation</td>
<td>Adrian Shields</td>
</tr>
<tr>
<td>22</td>
<td>Remediation Design Exercise</td>
<td>Adrian Shields</td>
</tr>
<tr>
<td>23</td>
<td>Remediation Economics</td>
<td>Dr A. Butler</td>
</tr>
<tr>
<td>24</td>
<td>Client’s Perspective</td>
<td>Matthew Pearce</td>
</tr>
</tbody>
</table>
3.0 Intended learning outcomes

On successfully completing this course unit, students will be able to:

- Understand the regulatory framework governing contaminated land assessment and its remediation.
- Understand the processes that govern the fate and transport of contaminants in the subsurface and how they can be understood and simulated using mathematical models.
- Apply physical principles and models to understand the source, movement, fate and environmental impact of contaminants and how these can be evaluated in terms of risk.
- Use economic principles in remediation decision making and in the choice of remediation technologies.

4.0 Teaching methods

Weekly lectures by a variety of speakers from both academia and industry.

5.0 Assessment

The assessment of the module is by examination only.

6.0 Recommended textbooks

Category as defined by Central Library:

C = Core, S = Supplementary

Recommended pre-course texts:

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td>S</td>
<td>Hydrogeology: Principles &amp; Practice (Hiscock, 2005)</td>
</tr>
<tr>
<td>S</td>
<td>Physical and Chemical Hydrogeology (Domenico &amp; Schwartz, 1998)</td>
</tr>
</tbody>
</table>

Recommended course texts:

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<tr>
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</thead>
<tbody>
<tr>
<td>S</td>
<td>Contaminant Hydrogeology (Fetter, 2008)</td>
</tr>
<tr>
<td>S</td>
<td>Economics of Groundwater remediation (Hardisty and Ozedemiroglu, 2004)</td>
</tr>
</tbody>
</table>
The table below shows how the themes of design, sustainability and health & safety risk management are embedded in the curriculum (as defined by the JBM degree guidelines).

Key: Primary (P), Secondary (S) and Contributory (C).

<table>
<thead>
<tr>
<th>Design</th>
<th>Health &amp; Safety Risk Management</th>
<th>Sustainability</th>
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<tr>
<td>S</td>
<td>S</td>
<td>P</td>
</tr>
</tbody>
</table>
1.0 Aims

- To gain insight into the design of environmental engineering processes.
- To apply knowledge gained in lectures and general reading to a real-world problem in order to experience the need for engineering judgement, empiricism and an integrated approach.

2.0 Syllabus

Over the spring term it is intended that the class, working in small groups, will complete an outline design of a water, or a wastewater treatment works, or a solid waste materials recovery facility in order to provide experience in process formulation, appraisal and design. It is intended that each student will consider at least one constituent part of the overall design by working as a unit within the overall design team. The allocation of tasks for each unit will be decided by discussion within each team.

3.0 Intended learning outcomes

On successfully completing this course unit, students will be able to:

- Have an appreciation of the need for a well-organised teamwork approach to the solving of complex engineering design problems.

4.0 Teaching methods

The module involves working in small groups and consultations with the module instructors and invited experts.

5.0 Assessment

Assessment of this module is by coursework only.
The product of this work will be a single formal report for each group. The design project is a major item of formal coursework and marks will be allocated that contribute to the coursework component of the final degree. As part of the assessment, and to give feedback on the quality of the work, each group will give a brief presentation of their work and answer questions during a debriefing session.

6.0  Recommended textbooks

Category as defined by Central Library:

C = Core, S = Supplementary

<table>
<thead>
<tr>
<th></th>
<th></th>
<th>None required</th>
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<tbody>
<tr>
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</table>

7.0  Subject threads

The table below shows how the themes of design, sustainability and health & safety risk management are embedded in the curriculum (as defined by the JBM degree guidelines).

Key: Primary (P), Secondary (S) and Contributory (C).

<table>
<thead>
<tr>
<th>Design</th>
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</thead>
<tbody>
<tr>
<td>P</td>
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</tbody>
</table>
CI9-EE-06 Design Project Hydrology

<table>
<thead>
<tr>
<th>Course leader:</th>
<th>Dr Adrian Butler</th>
</tr>
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<tbody>
<tr>
<td>Other contributors:</td>
<td>Mr James Lau (Black &amp; Veatch), Dr Adrian Butler</td>
</tr>
<tr>
<td>Module status:</td>
<td>Core</td>
</tr>
<tr>
<td>Pre- or co-requisites:</td>
<td></td>
</tr>
<tr>
<td>Term:</td>
<td>Spring</td>
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<tr>
<td>Contact hours:</td>
<td>27</td>
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<td>ECTS units:</td>
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<td>FHEQ Level:</td>
<td>7</td>
</tr>
<tr>
<td>Assessment:</td>
<td>Coursework, presentations</td>
</tr>
</tbody>
</table>

1.0 Aims
- To provide the students with an opportunity to translate theory learnt in lectures into solving practical problems encountered in industry.
- To develop group working and presentational skills.

2.0 Syllabus
- There are two assignments, both of which are five weeks long. The first involves the design of a storm water drainage system, the second is a groundwater modelling project.

<table>
<thead>
<tr>
<th>No.</th>
<th>Topic</th>
<th>Staff</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>Urban drainage (introduction)</td>
<td>JL + colleagues</td>
</tr>
<tr>
<td>02</td>
<td>Urban drainage (practical 1)</td>
<td>JL + colleagues</td>
</tr>
<tr>
<td>03</td>
<td>Urban drainage (practical 1)</td>
<td>Industrial colleagues</td>
</tr>
<tr>
<td>04</td>
<td>Urban drainage (practical 1)</td>
<td>Industrial colleagues</td>
</tr>
<tr>
<td>05</td>
<td>Urban drainage (presentation)</td>
<td>JL + colleagues</td>
</tr>
<tr>
<td>06</td>
<td>Groundwater (introduction)</td>
<td>AB, DP</td>
</tr>
<tr>
<td>07</td>
<td>Groundwater (practical 1)</td>
<td>AB + BGS colleagues</td>
</tr>
<tr>
<td>08</td>
<td>Groundwater (practical 2)</td>
<td>AB + BGS colleagues</td>
</tr>
<tr>
<td>09</td>
<td>Groundwater (presentation)</td>
<td>AB, DP</td>
</tr>
</tbody>
</table>

3.0 Intended learning outcomes

On successfully completing this course unit, students will be able to:
- Convert knowledge and skills into design practice.
- Develop awareness of design challenges and solutions.
- Apply theory and numerical skills to realistic design problems, and write design reports.
4.0  Teaching methods

The module involves working in small groups, and consultations with the module instructors and invited experts. There will also be some lecturing on design methods.

5.0  Assessment

Assessment of this module is by coursework only.

Each component is assessed by a group report and group presentation. The presentation carries 20% of the marks and the report carries 80%.

6.0  Recommended textbooks

Category as defined by Central Library:

C = Core, S = Supplementary

<table>
<thead>
<tr>
<th></th>
<th>None recommended.</th>
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7.0  Subject threads

The table below shows how the themes of design, sustainability and health & safety risk management are embedded in the curriculum (as defined by the JBM degree guidelines).

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<tbody>
<tr>
<td>P</td>
<td>-</td>
<td>S</td>
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</tbody>
</table>
CI9-EE-07 Environmental Fluid Mechanics

1.0 Aims

- To develop topics in fluid mechanics and hydraulics of broad interest to environmental engineers and hydrologists, and demonstrate the link between theoretical studies and their practical application in river and environmental engineering.

2.0 Syllabus

- After 8 weeks of joint lectures environmental engineers consider basic flow in the porous media and hydrologists consider sediment transport in rivers.

<table>
<thead>
<tr>
<th>No.</th>
<th>Topic</th>
<th>Staff</th>
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<tbody>
<tr>
<td>01</td>
<td>Physical properties of fluid and pressure change</td>
<td>Dr A. Mijic</td>
</tr>
<tr>
<td>02</td>
<td>Fluid statics – Hydrostatic forces</td>
<td>Dr A. Mijic</td>
</tr>
<tr>
<td>03</td>
<td>Principles of fluid dynamics</td>
<td>Dr A. Mijic</td>
</tr>
<tr>
<td>04</td>
<td>Open channel flow: Basic equations</td>
<td>Dr A. Mijic</td>
</tr>
<tr>
<td>05</td>
<td>Open channel flow: Steady state 1</td>
<td>Dr A. Mijic</td>
</tr>
<tr>
<td>06</td>
<td>Open channel flow: Steady state 2</td>
<td>Dr A. Mijic</td>
</tr>
<tr>
<td>07</td>
<td>Flow in pipes – Sheer stress</td>
<td>Dr A. Mijic</td>
</tr>
<tr>
<td>08</td>
<td>Flow in pipes – Pressure and energy distribution</td>
<td>Dr A. Mijic</td>
</tr>
<tr>
<td>09 EE</td>
<td>Flow in porous media - Basic hydraulics</td>
<td>Dr A. Mijic</td>
</tr>
<tr>
<td>09 HWRM</td>
<td>Sediment transport in rivers</td>
<td>Dr P. Soar</td>
</tr>
</tbody>
</table>

3.0 Intended learning outcomes

On successfully completing this course unit, students will be able to:

- Understand the fundamental properties of fluids.
- Calculate pressures and forces exerted by fluids at rest.
• Understand how fundamental equations of mass balance, momentum balance, energy balance, and friction losses are used to derive engineering equations that describe steady flow of water in open channels, associated water levels, pressures and forces.

• Understand how channel expansions and contractions, and lateral inflow and outflow affect open channel flow behaviour.

• Use that understanding to solve simple steady state open channel flow problems, including hydraulic jumps and flow profile sketching.

• Understand how to apply the principles of fluids to solve simple problems of pressurized flow in pipes.

• Understand how to apply the principles of fluids to solve simple problems of flow through porous media (EE only).

• Distinguish between the alternative types of sediments in rivers and methods for estimating their transport (Hydrology only).

• Recognise the links between the theory of fluid mechanics and the theories and practices taught in other related modules in this MSc (e.g. urban water, flood hydrology, hydrological processes, hydrogeology, water distribution systems, hydroinformatics).

4.0 Teaching methods

This module is taught through lectures, joint lectures for both HWRM and EE, and a visit from an external lecturer (tbc).

5.0 Assessment

Assessment of the module is by examination.

6.0 Recommended textbooks

Category as defined by Central Library: C = Core, S = Supplementary

<table>
<thead>
<tr>
<th>Category</th>
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<tbody>
<tr>
<td>S</td>
<td><em>Open channel flow</em>, Henderson, Macmillan Press.</td>
</tr>
</tbody>
</table>
7.0 Subject threads

The table below shows how the themes of design, sustainability and health & safety risk management are embedded in the curriculum (as defined by the JBM degree guidelines).

Key: Primary (P), Secondary (S) and Contributory (C).

<table>
<thead>
<tr>
<th>Design</th>
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<tbody>
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<td>-</td>
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</tbody>
</table>
CI9-EE-08 Environmental Management & Decision Making

**Course leader:** Professor Nick Voulvoulis  
**Other contributors:** Dr Yiannis Kountouris, Professor Richard Murphy  
**Module status:** Core H2UM  
**Pre- or co-requisites:** None  
**Term:** Spring  
**Contact hours:** 10  
**ECTS units:** 1.5  
**FHEQ Level:** 7  
**Assessment:** Written examination

### 1.0 Aims

- To introduce students to some of the most important management tools and techniques for environmental decision making.
- To demonstrate the relevance of context in selecting appropriate tools and understand their strength and weaknesses through a case study.

### 2.0 Syllabus

<table>
<thead>
<tr>
<th>No.</th>
<th>Topic</th>
<th>Staff</th>
</tr>
</thead>
<tbody>
<tr>
<td>16</td>
<td>Risk-Based Decision-Making and Environmental Management</td>
<td>Professor Nick Voulvoulis</td>
</tr>
<tr>
<td>17</td>
<td>Multi-Criteria Analysis</td>
<td>Professor Nick Voulvoulis</td>
</tr>
<tr>
<td>18</td>
<td>Cost Benefit and Evaluation</td>
<td>Dr Yiannis Kountouris</td>
</tr>
<tr>
<td>19</td>
<td>Decision-Making Tools: Case Study</td>
<td>Professor Nick Voulvoulis</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Dr Yiannis Kountouris</td>
</tr>
<tr>
<td>20</td>
<td>Life-Cycle Analysis</td>
<td>Professor Richard Murphy</td>
</tr>
</tbody>
</table>

### 3.0 Intended learning outcomes

On successfully completing this course unit, students will be able to:

- Appreciate the use of decision making tools to solve environmental problems.
- Enable the selection and use of certain management techniques and policy tools to support decision making in environmental management and policy.
- Understand the role of evidence and data in decision-making to improve both the quality of the process, and the acceptability of the outcome.
- Understand the different stakeholder perspectives in environmental problems.
4.0 Teaching methods
The content of this module will be delivered through lectures, video presentations, and interactive classwork.

5.0 Assessment
Assessment for this module is by examination only.

6.0 Recommended textbooks
Category as defined by Central Library:
C = Core, S = Supplementary

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<table>
<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td>S</td>
<td>Multi-criteria analysis: a manual, <a href="http://eprints.lse.ac.uk/12761/1/Multi-criteria_Analysis.pdf">http://eprints.lse.ac.uk/12761/1/Multi-criteria_Analysis.pdf</a></td>
</tr>
</tbody>
</table>

7.0 Subject threads
The table below shows how the themes of design, sustainability and health & safety risk management are embedded in the curriculum (as defined by the JBM degree guidelines).

Key: Primary (P), Secondary (S) and Contributory (C).

<table>
<thead>
<tr>
<th>Design</th>
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<th>Sustainability</th>
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<tbody>
<tr>
<td>S</td>
<td>C</td>
<td>P</td>
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</tbody>
</table>
CI9-EE-09 Environmental Management in Developing Countries

<table>
<thead>
<tr>
<th>Course leader:</th>
<th>Dr Michael Templeton</th>
</tr>
</thead>
<tbody>
<tr>
<td>Other contributors:</td>
<td>Invited guest lecturers</td>
</tr>
<tr>
<td>Module status:</td>
<td>Core H2UM, H2UP</td>
</tr>
<tr>
<td>Pre- or co-requisites:</td>
<td>3</td>
</tr>
<tr>
<td>Term:</td>
<td>Spring</td>
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<tr>
<td>Contact hours:</td>
<td>18</td>
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<tr>
<td>ECTS units:</td>
<td></td>
</tr>
<tr>
<td>FHEQ Level:</td>
<td>7</td>
</tr>
<tr>
<td>Assessment:</td>
<td>Written examination</td>
</tr>
</tbody>
</table>

1.0 Aims

- Gain insight and understanding of the inter-relationships between water, wastes and health in developing countries.
- Examine the issues of tropical public health, and study an introduction to epidemiology and water-borne, insect-borne and helminth diseases and their control in relation to water supply, sanitation and irrigation.
- Consider impacts of air pollution. Particular topics include the choice of water source and its protection, low-cost water treatment, distribution and storage, planning and design of low-cost sanitation, effluent re-use, and waste management and disposal in environmentally developing countries.
- Provide examples of field practice and case studies.
- Cover a broad range of multidisciplinary subject fields relevant to environmental management in developing countries.

2.0 Syllabus

<table>
<thead>
<tr>
<th>Week No.</th>
<th>Topic</th>
<th>Staff</th>
</tr>
</thead>
<tbody>
<tr>
<td>16</td>
<td>Introduction</td>
<td>Dr M. Templeton</td>
</tr>
<tr>
<td>17</td>
<td>Water and health in developing countries</td>
<td>Invited lecturer</td>
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<tr>
<td>18</td>
<td>Water and health in developing countries</td>
<td>Invited lecturer</td>
</tr>
<tr>
<td>19</td>
<td>Water supply and treatment</td>
<td>Dr M. Templeton</td>
</tr>
<tr>
<td>20</td>
<td>Low cost sanitation</td>
<td>Dr M. Templeton</td>
</tr>
<tr>
<td>21</td>
<td>Stormwater drainage in developing countries</td>
<td>Invited lecturer</td>
</tr>
<tr>
<td>22</td>
<td>Sustainable waste management in developing countries</td>
<td>Invited lecturer</td>
</tr>
<tr>
<td>23</td>
<td>Sustainable waste management in developing countries</td>
<td>Invited lecturer</td>
</tr>
<tr>
<td>24</td>
<td>Land use management and water</td>
<td>Invited lecturer</td>
</tr>
</tbody>
</table>
3.0 Intended learning outcomes

On successfully completing this course unit, students will be able to:

- Understand the problems and challenges of water, waste and environmental management in developing countries and the potential impacts on human health and environmental quality.
- Identify and evaluate appropriate technologies and management practices for potable water supply and treatment, and wastewater management in environmentally developing countries at different scales.
- Understand the fundamental epidemiology of water-related diseases and to critically evaluate appropriate engineering and management control strategies.
- Critically examine options and strategies to alleviate health and environmental impacts associated with the disposal of solid waste in developing countries.

4.0 Teaching methods

The course is delivered in the spring term as a set of 9 lectures.

5.0 Assessment

Assessment of this module is by written examination.

6.0 Recommended textbooks

Category as defined by Central Library:

C = Core, S = Supplementary

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<tbody>
<tr>
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</table>

7.0 Subject threads

The table below shows how the themes of design, sustainability and health & safety risk management are embedded in the curriculum (as defined by the JBM degree guidelines).

Key: Primary (P), Secondary (S) and Contributory (C).

<table>
<thead>
<tr>
<th>Design</th>
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</table>
CI9-EE-10 Environmental Analysis

<table>
<thead>
<tr>
<th>Course leader</th>
<th>Dr Geoff Fowler</th>
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<tr>
<td>Other contributors</td>
<td>Dr Ángel Nievas-Pino</td>
</tr>
<tr>
<td>Module status</td>
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<tr>
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<td>Term</td>
<td>Autumn</td>
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<tr>
<td>Contact hours</td>
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</tr>
<tr>
<td>Assessment</td>
<td>Coursework</td>
</tr>
</tbody>
</table>

1.0 Aims

- This hands-on laboratory-based module involves undertaking a number of weekly experiments which will introduce the participants to water quality indicator, environmental sample analysis techniques and analytical data quality that relate to the overall scope of the Environmental Engineering course.

- Over the term-long course the student will gain an in-depth understanding of how to perform essential wet chemical processes and instrumental analysis techniques relevant to water quality, soil and waste assessment and treatment. The instrumental and wet chemical analysis methods introduced and utilised will provide a deeper understanding of the challenges and problems commonly encountered during the assessment of environmental samples.

- Ultimately, familiarity with chemical techniques will enable a better communication between environmental engineers and chemical laboratories.

- Completion of this course is essential for students without prior laboratory experience who wish to undertake a laboratory-based research project.

2.0 Syllabus

- The core experiments will use techniques and procedures which will be considered include: titrations, pH, colourimetric wet chemical analysis, acid digestions, COD, Kjeldahl nitrogen, ozonation, activated carbon adsorption, metal analysis using AAS and ICP-OES and organic analysis by UV-Vis techniques.
### Module Descriptor

**Department of Civil and Environmental Engineering**

<table>
<thead>
<tr>
<th>No.</th>
<th>Topic</th>
<th>Staff</th>
</tr>
</thead>
</table>
| 01  | Laboratory Induction, Safety briefing  
 Experiment 1 – Titrations & analytical data quality                  | Dr G. Fowler  
 Dr A. Nievas-Pino                   |
| 02  | Experiment 2 – Ultraviolet/Visible Spectroscopy for the analysis of water | Dr G. Fowler  
 Dr A. Nievas-Pino                   |
| 03  | Experiment 3 – Chemical Oxygen Demand: COD                            | Dr G. Fowler  
 Dr A. Nievas-Pino                   |
| 04  | Experiment 4 – Determination of Metal contamination in Soil: Acid digestion and ICP-AES analysis | Dr G. Fowler  
 Dr A. Nievas-Pino                   |
| 05  | NO CLASS                                                              |                                      |
| 06  | Experiment 6 – Ozonation for the treatment of contaminated waters     | Dr G. Fowler  
 Dr A. Nievas-Pino                   |
| 07  | Experiment 7 – Adsorption of pollutants by activated carbon          | Dr G. Fowler  
 Dr A. Nievas-Pino                   |
| 08  | Experiment 8 – Ca and Mg hardness of water                            | Dr G. Fowler  
 Dr A. Nievas-Pino                   |
| 09  | Experiment 9 – Kjeldahl nitrogen                                      | Dr G. Fowler  
 Dr A. Nievas-Pino                   |
| 10  | Experiment 10 – Atomic Absorption Spectrophotometry                   | Dr G. Fowler  
 Dr A. Nievas-Pino                   |

### 3.0 Intended learning outcomes

On successfully completing this course unit, students will have knowledge of:

- The core principles of good laboratory practice.
- Laboratory health and safety.
- Understanding and applying risk assessments for laboratory work.
- The application of the different ways of expressing the quantities of chemicals in samples.
- Correct sample preparation for reliable data and reproducible analysis.
- An understanding of key wet chemical and instrumental analysis methodologies.
- The importance of data quality assurance.
- Limitations of analytical techniques.
- Key methodologies as applied to laboratory work
- How to use laboratory equipment correctly
4.0 Teaching methods

This laboratory course is delivered as practical classes with detailed written methods, demonstrations and instructions.

5.0 Assessment

By coursework: Individual laboratory reports submitted the week after the experiment. No examination.

6.0 Recommended textbooks

Category as defined by Central Library:

C = Core, S = Supplementary

<table>
<thead>
<tr>
<th></th>
<th>Quantitative Chemical Analysis, Daniel C Harris, 8th Edition</th>
</tr>
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<tbody>
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</table>

7.0 Subject threads

The table below shows how the themes of design, sustainability and health & safety risk management are embedded in the curriculum (as defined by the JBM degree guidelines).

Key: Primary (P), Secondary (S) and Contributory (C).

<table>
<thead>
<tr>
<th>Design</th>
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<th>Sustainability</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>S</td>
<td>C</td>
</tr>
</tbody>
</table>
1.0 Aims

- To understand: general approaches to groundwater resource evaluation, quantitative models of aquifer systems and the role of numerical methods, techniques for solving the groundwater flow equation including finite different and the method of lines.

2.0 Syllabus

- Groundwater modelling techniques – Finite difference techniques – (Steady-state/Transient).

<table>
<thead>
<tr>
<th>Week No.</th>
<th>Topic</th>
<th>Staff</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>Groundwater resource evaluation</td>
<td>Dr A. Mijic</td>
</tr>
<tr>
<td>02</td>
<td>Finite Difference – Steady State 1</td>
<td>Dr A. Mijic</td>
</tr>
<tr>
<td>03</td>
<td>Finite Difference – Steady State 2</td>
<td>Dr A. Mijic</td>
</tr>
<tr>
<td>04</td>
<td>Finite Difference – Transient 1</td>
<td>Dr A. Mijic</td>
</tr>
<tr>
<td>05</td>
<td>Finite Difference – Transient 2</td>
<td>Dr A. Mijic</td>
</tr>
<tr>
<td>06</td>
<td>Finite Difference – Advection Dispersion 1</td>
<td>Dr A. Mijic</td>
</tr>
<tr>
<td>07</td>
<td>Finite Difference – Advection Dispersion 2</td>
<td>Dr A. Mijic</td>
</tr>
<tr>
<td>08</td>
<td>Stochastic processes in groundwater modelling</td>
<td>Dr A. Butler</td>
</tr>
<tr>
<td>09</td>
<td>Building groundwater models</td>
<td>Dr C. Jackson</td>
</tr>
</tbody>
</table>
3.0 Intended learning outcomes

On successfully completing this course unit, students will be able to:

- To understand the methods and limitations that underlie numerical models.
- To be able to develop and implement numerical solutions using mathematical programming and apply these to solving groundwater problems.

4.0 Teaching methods

18 hours of lectures and (MATLAB based) tutorials over 9 sessions.

5.0 Assessment

Assessment of this module is by coursework only.

6.0 Recommended textbooks

Category as defined by Central Library:

C = Core, S = Supplementary

|---|-----------------------------------------------------------------------|

7.0 Subject threads

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CI9-EE-12 Hydrogeology and Groundwater

<table>
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<tr>
<th>Course leader:</th>
<th>Dr Adrian Butler</th>
</tr>
</thead>
<tbody>
<tr>
<td>Other contributors:</td>
<td>Professor Denis Peach</td>
</tr>
<tr>
<td>Module status:</td>
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<td>Pre- or co-requisites:</td>
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<td>Term:</td>
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<td>7</td>
</tr>
<tr>
<td>Assessment:</td>
<td>Coursework, written examination</td>
</tr>
</tbody>
</table>

1.0 Aims

- To provide a foundation in analytical groundwater as a basis for understanding groundwater behaviour and management. This involves understanding groundwater flow and storage in terms of physical principles and mathematical representations.
- To show how physical measurements and tests can be undertaken to evaluate groundwater flow, aquifer hydraulic properties and well yield.
- To show the importance of groundwater quality.

2.0 Syllabus

- Geology and hydrogeology – rocks, geological formations, aquifers.
- Groundwater hydraulics – Darcy’s law – How groundwater moves through rocks, basic law of groundwater flow.
- Steady-state groundwater flow - Use of mass balance to develop continuity equation.
- Aquifer stress & groundwater storage - Ability of rocks to yield water.
- Transient groundwater flow – Time-dependent changes in groundwater flow.
- Pumping tests - Methods for obtaining aquifer parameters and testing yield of wells.
- Groundwater quality – Natural processes affecting groundwater quality.
- Case studies of groundwater systems.
**Department of Civil and Environmental Engineering**

<table>
<thead>
<tr>
<th>No.</th>
<th>Topic</th>
<th>Staff</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>Introduction – Groundwater occurrence &amp; distribution, role in hydrological cycle. Basic terminology - groundwater column.</td>
<td>Dr A. Butler</td>
</tr>
<tr>
<td>02</td>
<td>Groundwater hydraulics – How groundwater moves through rocks, basic law of groundwater flow (Darcy's law).</td>
<td>Dr A. Butler</td>
</tr>
<tr>
<td></td>
<td><strong>Field Trip</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Practical hydrogeology session at field site in Berkshire.</td>
<td>Dr A. Butler</td>
</tr>
<tr>
<td>03</td>
<td>Geology and hydrogeology – rocks, geological formations, aquifers.</td>
<td>Professor D. Peach</td>
</tr>
<tr>
<td>04</td>
<td>Steady-state groundwater flow – Use of mass balance to develop continuity equation.</td>
<td>Dr A. Butler</td>
</tr>
<tr>
<td>05</td>
<td>Aquifer stress &amp; groundwater storage – Ability of rocks to yield water.</td>
<td>Dr A. Butler</td>
</tr>
<tr>
<td>06</td>
<td>Transient groundwater flow – Time-dependent changes in groundwater flow.</td>
<td>Dr A. Butler</td>
</tr>
<tr>
<td>07</td>
<td>Pumping tests – Methods for obtaining aquifer parameters and testing yield of wells.</td>
<td>Dr A. Butler</td>
</tr>
<tr>
<td>08</td>
<td>Groundwater quality – Natural processes affecting groundwater quality.</td>
<td>Dr A. Butler</td>
</tr>
<tr>
<td>09</td>
<td>Hydrogeological applications &amp; case studies.</td>
<td>Professor D. Peach</td>
</tr>
</tbody>
</table>

### 3.0 Intended learning outcomes

On successfully completing this course unit, students will be able to:

- To understand the basic principles of groundwater flow and how this can be determined in the field and analysed using models, which are conditioned on field test data and the importance of groundwater as a resource and the need to protect it, both in terms of quantity and quality.

### 4.0 Teaching methods

18 hours of lectures and tutorials over 9 sessions, with accompanying problem sheets. In addition, there will be a field practical at a site in Berkshire, which will be run by Denis Peach, a visiting Professor in the Department.

### 5.0 Assessment

By examination and a piece of coursework based on the field practical.
6.0 Recommended textbooks

Category as defined by Central Library:

C = Core, S = Supplementary

<table>
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<th></th>
<th>Health &amp; Safety Risk Management</th>
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7.0 Subject threads

The table below shows how the themes of design, sustainability and health & safety risk management are embedded in the curriculum (as defined by the JBM degree guidelines).

Key: Primary (P), Secondary (S) and Contributory (C).
CI9-EE-13 Hydroinformatics

<table>
<thead>
<tr>
<th>Course leader:</th>
<th>Dr Athanasios Paschalis</th>
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<td>Module status:</td>
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<td>Term:</td>
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<td>FHEQ Level:</td>
<td>7</td>
</tr>
<tr>
<td>Assessment:</td>
<td>Coursework only</td>
</tr>
</tbody>
</table>

1.0 Aims

- To make use of advanced computational methods and information technologies in the application areas of hydraulics, hydrology and environmental engineering.
- Learn fundamental computing skills and their application in Matlab necessary for the physical modelling, numerical simulation and data analysis of various environmental processes. These hands-on skills are required and further enhanced in complementary modules of the course.

2.0 Syllabus

- Introduction to Hydroinformatics and starting with Matlab.
- Programming in Matlab: Script Files and Functions.
- Working with Arrays and Graphics.
- Regression Analysis (Curve Fitting) and Interpolation.
- Numerical Integration.
- Root Finding.
- Linear Algebra.
- Applications in Numerical Analysis (Case Studies).

<table>
<thead>
<tr>
<th>No.</th>
<th>Topic</th>
<th>Staff</th>
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<tbody>
<tr>
<td>01</td>
<td>Introduction to Hydroinformatics and Matlab</td>
<td>Dr A. Paschalis</td>
</tr>
<tr>
<td>02</td>
<td>Working with arrays, vectors and matrices</td>
<td>Dr A. Paschalis</td>
</tr>
<tr>
<td>03</td>
<td>Programming in Matlab - Scripts &amp; Functions</td>
<td>Dr A. Paschalis</td>
</tr>
<tr>
<td>04</td>
<td>Programming in Matlab - Logical Operators</td>
<td>Dr A. Paschalis</td>
</tr>
<tr>
<td>05</td>
<td>Programming in Matlab - Using control flow statements</td>
<td>Dr A. Paschalis</td>
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<tr>
<td>06</td>
<td>Applications in Numerical Analysis - Part I (Fitting Data, Interpolation)</td>
<td>Dr A. Paschalis</td>
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<tr>
<td>07</td>
<td>Application in Numerical Analysis - Part II (Root Finding, Numerical Differentiation/Integration)</td>
<td>Dr A. Paschalis</td>
</tr>
</tbody>
</table>
3.0 Intended learning outcomes

On successfully completing this course unit, students will be able to:

- Develop structured computer programmes using MATLAB.
- Implement algorithms and utilise the powerful intrinsic functions of MATLAB for solving mathematical problems and data analysis and visualisation tasks.
- Apply various numerical methods for solving common environmental engineering problems.
- Have a good understanding of a range of physical processes, advanced modelling techniques and information technology for water management.

4.0 Teaching methods

The module is classroom-based and taught via a combination of formal lectures and computer sessions. Lectures and web-based material (via Blackboard Learn) introduce the basic concepts and techniques. Tutorials reinforce the acquired knowledge and support the development of practical skills. Assignments develop ability to use knowledge in problem solving tasks. Students are required to have their own laptops for use in these sessions.

5.0 Assessment

Assessment is by coursework only (in-class progress tests).

6.0 Recommended textbooks

Category as defined by Central Library:

C = Core, S = Supplementary

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7.0 Subject threads

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CI9-EE-14 Hydrological Processes

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<td>ECTS units:</td>
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<td>FHEQ Level:</td>
<td>7</td>
</tr>
<tr>
<td>Assessment:</td>
<td>Coursework, written examination</td>
</tr>
</tbody>
</table>

1.0 Aims

- To understand the physical processes that determine the exchange of water at the Earth’s surface.
- To become familiar with the physical properties that govern the movement of water through the unsaturated zone and how these can be observed in the field and modelled mathematically.
- To understand the physical factors that control evaporation and their representation using energy fluxes and diffusive transfer.
- To be familiar with the various physical and empirical models used to calculate evaporation and the data need to support their use.

2.0 Syllabus

<table>
<thead>
<tr>
<th>No.</th>
<th>Topic</th>
<th>Staff</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>Introduction; Rainfall Runoff Processes</td>
<td>Dr A. Butler</td>
</tr>
<tr>
<td>02</td>
<td>Soil and Soil Water; Properties, Processes &amp; Measurement</td>
<td>Dr A. Butler</td>
</tr>
<tr>
<td>03</td>
<td>Hydraulic Conductivity and Flow in the Unsaturated Zone</td>
<td>Dr A. Butler</td>
</tr>
<tr>
<td>04</td>
<td>Transient Unsaturated Flow</td>
<td>Dr A. Butler</td>
</tr>
<tr>
<td>05</td>
<td>Water in the Atmosphere; Water in the Plant</td>
<td>Dr A. Butler</td>
</tr>
<tr>
<td>06</td>
<td>Evaporation and the Penman Monteith Combination Equation</td>
<td>Dr A. Butler</td>
</tr>
<tr>
<td>07</td>
<td>Evaporation Measurement and Estimation</td>
<td>Dr A. Butler</td>
</tr>
<tr>
<td>08</td>
<td>Modelling Recharge and Runoff</td>
<td>Dr A. Butler</td>
</tr>
<tr>
<td>09</td>
<td>Hydrological Processes in Different Climates: Group Presentations</td>
<td>Dr A. Butler</td>
</tr>
</tbody>
</table>

3.0 Intended learning outcomes

On successfully completing this course unit, students will be able to:

- Have an understanding of catchment hydrological processes, which is foundational for the hydrology Master’s course.
• Understand how measurements can be made of key hydrological variables.
• Use models, conditioned on physical measurements, to simulate unsaturated flow, groundwater recharge and rainfall-runoff.

4.0 Teaching methods
Lectures and tutorial sessions, supported by problem sheets and an item of coursework. The students are also asked to make presentations on specified topics related to the module.

5.0 Assessment
One examination and a piece of coursework.

6.0 Recommended textbooks
Category as defined by Central Library:

C = Core, S = Supplementary

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
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<tr>
<td>C</td>
<td>Ward, R.C. and M. Robinson Principles of Hydrology, 4th edn., Mcgraw-Hill, 2000: Especially chapters 3 (Interception), 4 (Evaporation), 7 (Runoff) and 9 (The drainage basin and beyond)</td>
</tr>
<tr>
<td>S</td>
<td>Smith, K.A. and Mullins, C.E., Soil and environmental analysis: physical methods, Marcel Dekker, 2000</td>
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</table>

7.0 Subject threads
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CI9-EE-15 Hydrometry

<table>
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<tr>
<th>Course leader:</th>
<th>Dr Wouter Buytaert</th>
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<tr>
<td>Other contributors:</td>
<td>Nick Everard, UK Environment Agency</td>
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<td>7</td>
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<tr>
<td>Assessment:</td>
<td>Coursework</td>
</tr>
</tbody>
</table>

1.0 Aims

- To introduce the concepts and techniques used in hydrometry, focusing on description of the theory and practice behind traditional, new, and future techniques of measuring hydrological fluxes.
- To cover the theoretical basis of streamflow and precipitation measurements, drawing on theory from associated modules, but concentrating on the practical issues governing choice of methods, accuracy and cost.
- To introduce new and emerging methods for hydrometeorological measurements, with focus on remote sensing and pervasive sensing networks.
- Describe and discuss data storage, quality control further processing.

2.0 Syllabus

- Introduction in hydrometry, including aims, objectives and examples.
- A critical review of flow measurement methods, including the velocity-area method; measurement of stage; stage-discharge relationships; the slope-area method; dilution gauging; float gauging; weirs and flumes; ultrasonic cross-path method; electromagnetic methods; acoustic Doppler Velocity meters, local non-contact methods.
- Hydrometrical data analysis and quality control, including peaks over threshold, annual maxima, application of extreme value distributions, regional flood frequency analysis, and double mass curves.

<table>
<thead>
<tr>
<th>No.</th>
<th>Topic</th>
<th>Staff</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>Background to hydrometry. Velocity-area method. Current meters. Float gauging</td>
<td>Dr W. Buytaert</td>
</tr>
<tr>
<td>02</td>
<td>Measurement of stage. Stage-discharge relationships. Identification and extrapolation. Slope-area method.</td>
<td>Dr W. Buytaert</td>
</tr>
<tr>
<td>03</td>
<td>Tutorial. Section and channel controls. Weirs and flumes.</td>
<td>Dr W. Buytaert</td>
</tr>
<tr>
<td>05</td>
<td>Data management and quality control. Data error and uncertainty analysis</td>
<td>Dr W. Buytaert</td>
</tr>
</tbody>
</table>
The full-day field trip allows students to apply knowledge learned and implement a number of the flow measurement techniques studied.

### 3.0 Intended learning outcomes

On successfully completing this course unit, students will be able to:

- Have an excellent appreciation of the strengths and weaknesses of different methods to measure hydrological fluxes, and will be able to select appropriate methods based on field conditions, stream type, and application, and to process and analyse hydrometrical data accordingly.

### 4.0 Teaching methods

Teaching consists of lectures and tutorials, and a full-day field trip.

### 5.0 Assessment

The assessment of the module is by coursework only which consists of a critical analysis of the field measurements collected during the field trip.

### 6.0 Recommended textbooks

Category as defined by Central Library: C = Core, S = Supplementary

|-------|-------------------------------------------------------------------|

### 7.0 Subject threads

The table below shows how the themes of design, sustainability and health & safety risk management are embedded in the curriculum (as defined by the JBM degree guidelines).

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<tbody>
<tr>
<td>P</td>
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</tbody>
</table>
1.0 Aims

- To give a solid grounding in the concepts of probability and statistical modelling.
- Emphasis is placed on asking the right questions, and testing and questioning assumptions, and on using robust statistical tools that can cope with departures from the assumptions. Graphical analyses are used whenever possible, and "exploratory" data analysis is encouraged. Exercises are introduced regularly throughout the lectures to immediately reinforce the material being discussed; these are usually of a practical nature.

2.0 Syllabus

- This course gives students an introduction to basic probability and statistics, with applications relevant to Environmental Engineering and Hydrology.
- It begins with descriptive statistics and graphical display of information. Probability theory and random variables are introduced with examples of practical applications.
- The second half of the course covers topics in statistical inference, including estimation, hypothesis testing and linear regression.
- The final topic is modelling extreme events, for instance peak river flows, using the Gumbel distribution.
<table>
<thead>
<tr>
<th>No.</th>
<th>Topic</th>
<th>Staff</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>Introductory examples. Data display and interpretation – Univariate measures of location, scale, asymmetry and shape; robust measures. Graphical summaries such as scatter plots, histograms, stem-and-leaf displays and box plots.</td>
<td>Professor N. Adams</td>
</tr>
<tr>
<td>02</td>
<td>Probability – Main rules of probability. Conditional probability.</td>
<td>Professor N. Adams</td>
</tr>
<tr>
<td>04</td>
<td>Random variables – Distribution and density functions for common continuous distributions.</td>
<td>Professor N. Adams</td>
</tr>
<tr>
<td>05</td>
<td>Estimation methods – Based around river flow data. The method of moments and maximum likelihood.</td>
<td>Professor N. Adams</td>
</tr>
<tr>
<td>06</td>
<td>Confidence intervals. Hypothesis testing 1.</td>
<td>Professor N. Adams</td>
</tr>
<tr>
<td>07</td>
<td>Hypothesis testing 2. Optional marked question 2.</td>
<td>Professor N. Adams</td>
</tr>
<tr>
<td>08</td>
<td>In-class hands-on session – hand written exercises and interpretation.</td>
<td>Professor N. Adams</td>
</tr>
<tr>
<td>09</td>
<td>Linear regression – Least-squares using mean sea level data.</td>
<td>Professor N. Adams</td>
</tr>
</tbody>
</table>

3.0 Intended learning outcomes

On successfully completing this course unit, students will be able to:

- Understand the concepts outlined in the lectures.

4.0 Teaching methods

The course is delivered in the autumn term as nine two-hour sessions, which will include lecture, class exercises and problem-solving.

5.0 Assessment

Assessment of this module is by examination only.
6.0  **Recommended textbooks**

Category as defined by Central Library:

C = Core, S = Supplementary

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<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>C</td>
<td>A full set of type-set lecture notes and figures covering the whole course are provided.</td>
<td></td>
</tr>
<tr>
<td>S</td>
<td>References provided during the course.</td>
<td></td>
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</tbody>
</table>

7.0  **Subject threads**

The table below shows how the themes of design, sustainability and health & safety risk management are embedded in the curriculum (as defined by the JBM degree guidelines).

Key: Primary (P), Secondary (S) and Contributory (C).

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<thead>
<tr>
<th>Design</th>
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</tbody>
</table>
CI9-EE-19 Meteorology and Climate Change

<table>
<thead>
<tr>
<th>Course leader:</th>
<th>Dr Wouter Buytaert</th>
</tr>
</thead>
<tbody>
<tr>
<td>Other contributors:</td>
<td>Professor Florian Pappenberger, European Centre for Medium Range Weather Forecasts (ECMWF)</td>
</tr>
<tr>
<td>Module status:</td>
<td>Core H2UP</td>
</tr>
<tr>
<td>Pre- or co-requisites:</td>
<td></td>
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<tr>
<td>Term:</td>
<td>Autumn</td>
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<tr>
<td>Contact hours:</td>
<td>18</td>
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<td>ECTS units:</td>
<td>3</td>
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<tr>
<td>FHEQ Level:</td>
<td>7</td>
</tr>
<tr>
<td>Assessment:</td>
<td>Written examination</td>
</tr>
</tbody>
</table>

1.0 Aims

- To provide an introduction to the atmospheric processes which govern the earth’s climate and which control the surface water fluxes of the hydrological cycle. The module starts with a synoptic overview of the earth’s energy budget as a major driver for planetary-scale motion and atmospheric instabilities.
- This includes the issue of climate change, the possible reasons for climate change, and natural variability of climate. Subsequently, the processes behind rainfall generation are considered. Lastly global and regional climate models are introduced and their use in weather forecasts and climate change projections is discussed.
- The module includes an excursion to the European Centre for Medium Range Weather Forecasts (ECMWF) in Reading.

2.0 Syllabus

- The atmosphere and the global energy balance: radiative heat transfer, sensible and latent heat fluxes, global energy budget, longitudinal and seasonal variability, energy fluxes, atmospheric motion.
- Atmospheric and planetary motion: energy transport, understanding the drivers of global atmospheric motion, location and mechanisms of the major global wind belts, basic concepts of general circulation in the atmosphere, and the role of oceans in the global energy cycle.
- Atmospheric moisture and precipitation: atmospheric water storage, condensation and droplet formation, cloud development, rainfall formation and the role of ice. Precipitation mechanisms.
- Global and regional climate models: principles and design of global circulation modelling; regional climate modelling and statistical weather generators.
3.0 Intended learning outcomes

On successfully completing this course unit, students will be able to:

- Understand the origin and drivers of general circulation patterns and their relation to local and regional precipitation patterns.
- Have an insight into short and medium range weather forecasting, long-term climate change projections, their downscaling, and their linking to impact models.
- Understand methods for precipitation measurements, including rain gauges and radar.
- Be familiar with emerging new technologies in meteorology, in particular remote sensing.

4.0 Teaching methods

The course consists of a suite of lectures and a half-day excursion to ECMWF.

5.0 Assessment

The assessment of the module is by examination only.

6.0 Recommended textbooks

Category as defined by Central Library: C = Core, S = Supplementary

<table>
<thead>
<tr>
<th></th>
<th>Comprehensive lecture notes are issued, together with various codes and guidance notes.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>IPCC, 2013. Climate Change 2013. The physical science basis. WMO/UNEP.</td>
</tr>
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</table>
7.0 Subject threads

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</table>
1.0 Aims

- To provide an introduction to microbiology relevant to environmental engineering and assumes little prior knowledge of the subject.
- To discuss fundamental aspects of microorganisms and microbial metabolism, and the behaviour and characteristics of the major microbial groups: bacteria, fungi, protozoa, algae, viruses, and metazoan helminths and their relevance to environmental engineering are described.
- To consider applied examples of environmental microbiology, including: environmental nutrient (nitrogen and phosphorus) transformations and processes, environmental pathogens and quantitative microbial risk assessment, biological wastewater treatment, and microbiological treatment of solid organic wastes and sludges.

2.0 Syllabus

- This module provides an introduction to understanding the microbiological fundamentals and applications required by environmental engineers.
- The basics of life processes, cells, metabolism, growth and reproduction are considered in the context of environmental engineering systems.
- The individual microbial groups are introduced and their characteristics and behaviour are discussed in the context of their role in environmental engineering systems.
- Specific attention is given to nutrient transformation processes and the scientific management and control of environmental pathogens.
- Finally, the module considers the fundamental microbiological principles applied in wastewater and biodegradable waste treatment processes.
3.0 Intended learning outcomes

On successfully completing this course unit, students will be able to:

- Understand the fundamental principles of microbial growth and development processes and how they are influenced by environmental factors in relation to environmental engineering systems.
- Appreciate the role, contribution and significance of different microbial groups and how they may be managed for environmental engineering purposes.
- Identify the critical pathways and mechanisms of environmental pathogen transmission and how they may be controlled and managed to reduce water related infectious disease.
- Consider the microbiological principles of biological wastewater, solid organic waste and sludge treatment in the engineering of these major processes.

4.0 Teaching methods

The course is delivered in the Autumn Term as a suite of nine two-hour lectures.

5.0 Assessment

Assessment of the module is by a combination of examination and coursework.
6.0 **Recommended textbooks**

Category as defined by Central Library:

C = Core, S = Supplementary

<table>
<thead>
<tr>
<th>Category</th>
<th>Author(s)</th>
<th>Title</th>
<th>Publisher</th>
<th>ISBN</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>Lester, J.N. and Birkett, J.W.</td>
<td>Microbiology and Chemistry for Environmental Scientists and Engineers</td>
<td>E &amp; FN Spon, London</td>
<td>0-419-22680-X</td>
</tr>
</tbody>
</table>

7.0 **Subject threads**

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</table>
CI9-EE-21 Rainfall-Runoff Modelling and Flood Hydrology

Course leader: Dr Athanasios Paschalis
Other contributors: Dr Jeff Neal, Professor Rob Lamb, Dr Thomas Kjeldsen, Michael Vaughan
Module status: Core H2UP
Pre- or co-requisites: Spring
Term: Spring
Contact hours: 18
ECTS units: 3
FHEQ Level: 7
Assessment: Written Examination and Coursework

1.0 Aims
- To introduce rainfall-runoff concepts and methods and to understand modelling methodologies. This is important as rainfall-runoff models are hydrological tools, extensively used to support flood and water resource design and management and, increasingly, in broader environmental management applications, including water quality and hydro-ecological modelling.
- To understand flood hydrology: current design, simulation methods, and developments needed to meet new challenges, such as the management of land use and climate change.

2.0 Syllabus

<table>
<thead>
<tr>
<th>Week No.</th>
<th>Topic</th>
<th>Staff</th>
</tr>
</thead>
<tbody>
<tr>
<td>16</td>
<td>Introduction; why to use rainfall-runoff models; modelling stages; model types; data requirements, and evolution of rainfall-runoff models. Introduction to Rainfall-Runoff Modelling Toolbox (RRMT).</td>
<td>Dr A. Paschalis</td>
</tr>
<tr>
<td>17</td>
<td>Flood inundation modelling.</td>
<td>Dr J. Neal</td>
</tr>
<tr>
<td>18</td>
<td>Soil Moisture Accounting and routing models. RRMT modelling tutorial.</td>
<td>Dr A. Paschalis</td>
</tr>
<tr>
<td>19</td>
<td>PDM and TOPMODEL.</td>
<td>Professor R. Lamb</td>
</tr>
<tr>
<td>20</td>
<td>Model calibration, sensitivity analysis, and uncertainty. Tutorial on automatic calibration, multi-objective analysis, sensitivity analysis and prediction uncertainty.</td>
<td>Dr A. Paschalis</td>
</tr>
<tr>
<td>21</td>
<td>Flood Estimation Handbook</td>
<td>Dr T. Kjeldsen</td>
</tr>
<tr>
<td>22</td>
<td>Predictions in ungauged basins: parameter regionalisation methods.</td>
<td>Dr A. Paschalis</td>
</tr>
<tr>
<td>23</td>
<td>Term project presentations.</td>
<td>Dr A. Paschalis</td>
</tr>
<tr>
<td>24</td>
<td>Flood forecasting.</td>
<td>Michael Vaughan</td>
</tr>
</tbody>
</table>
3.0 Intended learning outcomes

On successfully completing this course unit, students will be able to:

- Become familiar with rainfall-runoff models
- Carry out rainfall-runoff model-building and performance analysis.

4.0 Teaching methods

Lectures and tutorial sessions. The teaching materials are supported with tutorials in rainfall-runoff modelling using Imperial College Rainfall Runoff modelling toolbox (RRMT) throughout the same lecture.

5.0 Assessment

Assessment of the module is by a combination of examination and coursework.

6.0 Recommended textbooks

Category as defined by Central Library:

C = Core, S = Supplementary

<table>
<thead>
<tr>
<th>Core (C)</th>
<th>Supplementary (S)</th>
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7.0 Subject threads

The table below shows how the themes of design, sustainability and health & safety risk management are embedded in the curriculum (as defined by the JBM degree guidelines).

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<td>S</td>
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</tbody>
</table>
CI9-EE-22 Solid Waste Management

<table>
<thead>
<tr>
<th>Course leader:</th>
<th>Professor Chris Cheeseman</th>
</tr>
</thead>
<tbody>
<tr>
<td>Other contributors:</td>
<td>Professor Sue Grimes, Professor Stephen Smith, Dr Geoff Fowler, Dr Costas Velis, Dr Keith Knox, Dr Jan Gronow, Jeff Cooper, Dr Julian Parfitt, Professor Nick Voulvoulis</td>
</tr>
<tr>
<td>Module status:</td>
<td>Core H2UM</td>
</tr>
<tr>
<td>Pre- or co-requisites:</td>
<td></td>
</tr>
<tr>
<td>Term:</td>
<td>Spring</td>
</tr>
<tr>
<td>Contact hours:</td>
<td>18</td>
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<tr>
<td>FHEQ Level:</td>
<td>7</td>
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<tr>
<td>Assessment:</td>
<td>Written examination</td>
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</tbody>
</table>

1.0 Aims
- To review and critically assesses the management, disposal and recycling options for solid wastes.
- Participate in discussions on a wide range of important waste related issues, while focusing on the key engineering and technical aspects involved.

2.0 Syllabus

<table>
<thead>
<tr>
<th>Week No.</th>
<th>Topic</th>
<th>Staff</th>
</tr>
</thead>
<tbody>
<tr>
<td>16</td>
<td>Waste management legislation and drivers for change Circular economy</td>
<td>Professor N. Grimes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Professor S. Grimes</td>
</tr>
<tr>
<td>17</td>
<td>Waste incineration and energy from waste</td>
<td>Professor C. Cheeseman</td>
</tr>
<tr>
<td>18</td>
<td>Waste recycling and recovery</td>
<td>Dr J. Parfitt</td>
</tr>
<tr>
<td>19</td>
<td>Review of mechanical biological treatment of wastes</td>
<td>Dr C. Velis</td>
</tr>
<tr>
<td>20</td>
<td>Landfill, landfill leachate and landfill gas</td>
<td>Dr J. Gronow</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Dr K. Knox</td>
</tr>
<tr>
<td>21</td>
<td>Anaerobic treatment and composting of MSW</td>
<td>Professor S. R. Smith</td>
</tr>
<tr>
<td>22</td>
<td>Overview of hazardous waste management</td>
<td>Dr G. Fowler</td>
</tr>
<tr>
<td>23</td>
<td>Producer responsibility and sustainable products</td>
<td>Jeff Cooper</td>
</tr>
<tr>
<td>24</td>
<td>Pyrolysis and gasification for energy and resource management</td>
<td>Dr G. Fowler</td>
</tr>
</tbody>
</table>

3.0 Intended learning outcomes

On successfully completing this course unit, students will be able to:

- Have an overview of issues and technologies associated with managing wastes as resources.
4.0  Teaching methods
The course content, delivered in nine sessions will include lectures, seminars and discussion sessions. The module is delivered in lectures which will link to site visits on the MSc Study Tour.

5.0  Assessment
Assessment for this module is by examination only.

6.0  Recommended textbooks
Category as defined by Central Library:
C = Core, S = Supplementary

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<td>S</td>
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</table>

7.0  Subject threads
The table below shows how the themes of design, sustainability and health & safety risk management are embedded in the curriculum (as defined by the JBM degree guidelines).

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<thead>
<tr>
<th></th>
<th>Health &amp; Safety Risk Management</th>
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<tbody>
<tr>
<td>S</td>
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<td>P</td>
</tr>
</tbody>
</table>
CI9-EE-23 Stochastic Hydrology

**Course leader:** Dr Christian Onof  
**Other contributors:** David Cross, Benjamin Guo, Dr Auguste Gires (ENPC Paris Tech)  
**Module status:** Core H2UP  
**Pre- or co-requisites:**  
**Term:** Spring  
**Contact hours:** 18  
**ECTS units:** 3  
**FHEQ Level:** 7  
**Assessment:** Written examination

1.0 Aims

To introduce statistical methods used for hydrological design; some standard time series methods applied to the modelling of hydrological variables; the use of Monte Carlo simulation in quantifying uncertainty; some stochastic models used for the rainfall input to hydrological systems.

2.0 Syllabus

Topics covered will include:

- Time-series analysis: model definition and identification.
- Particular ARMA models of use in hydrology.
- Time-series analysis: forecasting, goodness-of-fit.
- Extreme-value analysis: annual maxima and partial duration series.
- Poisson-cluster modelling of rainfall time-series
- Multi-fractal modelling in hydrology

<table>
<thead>
<tr>
<th>Week No.</th>
<th>Topic</th>
<th>Staff</th>
</tr>
</thead>
<tbody>
<tr>
<td>16</td>
<td>Time series modelling: Motivation and the main Linear Models</td>
<td>Dr C. Onof</td>
</tr>
<tr>
<td>17</td>
<td>Time series modelling: ARIMA models</td>
<td>Dr C. Onof</td>
</tr>
<tr>
<td>18</td>
<td>Time-series modelling: Physical basis of ARIMA modelling + focus on the AR(1) model</td>
<td>Dr C. Onof</td>
</tr>
<tr>
<td>19</td>
<td>Time-series modelling: Goodness-of-fit and Forecasting</td>
<td>Dr C. Onof</td>
</tr>
<tr>
<td>20</td>
<td>Extreme-value estimation for hydrological design (I)</td>
<td>Dr C. Onof</td>
</tr>
<tr>
<td>21</td>
<td>Extreme value estimation for hydrological design (II)</td>
<td>David Cross</td>
</tr>
<tr>
<td>22</td>
<td>Stochastic Rainfall Modelling with Poisson cluster processes (I)</td>
<td>Dr C. Onof</td>
</tr>
</tbody>
</table>
3.0 Intended learning outcomes

On successfully completing this course unit, students will:

- Be able to use standard time-series models for hydrological modelling.
- Know about the range of approaches to rainfall modelling.
- Know how to estimate the frequency of extreme hydrological events.
- Have an understanding of tools available to estimate and model uncertainty.
- Have an ability to use software for the analysis and modelling of time-series.
- Have skills in rainfall modelling, ARIMA modelling, extreme-value estimation.

4.0 Teaching methods

A combination of lectures and tutorials.

5.0 Assessment

Assessment of the module is by examination only.

6.0 Recommended textbooks

Category as defined by Central Library:

C = Core, S = Supplementary

|---|--------------------------------------------------------------------------------------------------------|

7.0 Subject threads

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<tr>
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<th>Risk Management</th>
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</tbody>
</table>
CI9-EE-24 Urban Hydrology and Urban Drainage

<table>
<thead>
<tr>
<th>Course leader:</th>
<th>Dr Ana Mijic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Other contributors:</td>
<td>Dr Michael Templeton</td>
</tr>
<tr>
<td>Module status:</td>
<td>Core H2UM, H2UP</td>
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<td>Pre- or co-requisites:</td>
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<tr>
<td>Term:</td>
<td>Autumn</td>
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</tr>
<tr>
<td>Assessment:</td>
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</table>

1.0 Aims
To study the hydrology and water management requirements of urban areas.

2.0 Syllabus

<table>
<thead>
<tr>
<th>No.</th>
<th>Topic</th>
<th>Staff</th>
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</thead>
<tbody>
<tr>
<td>01</td>
<td>Introduction</td>
<td>Dr A. Mijic</td>
</tr>
<tr>
<td>02</td>
<td>Unit hydrograph theory</td>
<td>Dr A. Mijic</td>
</tr>
<tr>
<td>03</td>
<td>Flood frequency analysis</td>
<td>Dr A. Mijic</td>
</tr>
<tr>
<td>04</td>
<td>Hydraulics</td>
<td>Dr A. Mijic</td>
</tr>
<tr>
<td>05</td>
<td>Rainfall and stormwater</td>
<td>Dr A. Mijic</td>
</tr>
<tr>
<td>06</td>
<td>Stormwater and stormwater management</td>
<td>Dr A. Mijic</td>
</tr>
<tr>
<td>07</td>
<td>Stormwater management and wastewater</td>
<td>Dr M. Templeton</td>
</tr>
<tr>
<td>08</td>
<td>Wastewater and CSOs</td>
<td>Dr M. Templeton</td>
</tr>
<tr>
<td>09</td>
<td>Towards urban water management sustainability</td>
<td>Dr A. Mijic</td>
</tr>
</tbody>
</table>

3.0 Intended learning outcomes
On successfully completing this course unit, students will be able to:

- Introduce the effects of urbanisation on the hydrological cycle, develop basic methods of hydrological analysis including runoff models and flood frequency analysis.
- Review the basics of rainfall analysis and hydraulics, and apply this to storm, foul and combined sewer design.
- Explore sewer flow models, stormwater management and the increasing influence of sustainability principles.
4.0 Teaching methods

The module is delivered by lectures and in-class exercises.

5.0 Assessment

Assessment of the module is by examination.

6.0 Recommended textbooks

Category as defined by Central Library:

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<tr>
<td><strong>S</strong></td>
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<td><strong>S</strong></td>
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</tbody>
</table>
1.0 Aims

- To introduce: the general water availability/demand problem; the design method for water resources; the optimisation methods for the operation of water resource systems.
- To study the general practice of regional water resource management, as seen from the points of view of the industry and of the regulator.

2.0 Syllabus

- Introduction to the problems of water resources and water demand. Characteristics of water resources systems.
- Reservoir design: critical period methods.
- Reservoir design: probability matrix methods.
- Introduction to reservoir operation.
- Water management in practice: the regulator and water company’s respective perspectives.

<table>
<thead>
<tr>
<th>No.</th>
<th>Topic</th>
<th>Staff</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>An introduction to the problems of water resources and water demand. Characteristics of water resources systems</td>
<td>Dr C. Onof</td>
</tr>
<tr>
<td>02</td>
<td>Reservoir Design: Critical Period methods (I)</td>
<td>Dr C. Onof</td>
</tr>
<tr>
<td>03</td>
<td>Reservoir Design: Critical Period methods (II) + Probability Matrix Methods (I)</td>
<td>Dr C. Onof</td>
</tr>
<tr>
<td>04</td>
<td>Reservoir Design: Probability Matrix Methods (II)</td>
<td>Dr C. Onof</td>
</tr>
<tr>
<td>05</td>
<td>An Introduction to Reservoir Operation</td>
<td>Dr C. Onof</td>
</tr>
<tr>
<td>06</td>
<td>General Systems Theory and applications to Water Resources Management</td>
<td>Dr A. Mijic</td>
</tr>
<tr>
<td>07</td>
<td>Linear Programming in Water Resources Management</td>
<td>Dr A. Mijic</td>
</tr>
<tr>
<td>08</td>
<td>Water Resources Management in practice (II): the regulator’s perspective</td>
<td>Bob Hillier (EA)</td>
</tr>
</tbody>
</table>
### 3.0 Intended learning outcomes

On successfully completing this course unit, students will be able to:

- Appreciate the role of uncertainty in estimating water resource needs.
- Grasp the issues involved in operating a reservoir.
- Have an understanding of the main issues involved in managing assets.
- Know how to design a reservoir to meet demand given available river flows.
- Know how to estimate the probability of failure of a reservoir.
- Know how to make sense of and best use a control diagram for reservoir operation.
- Understand the notion of headroom.
- Skills in the use of probability distributions to estimate risk.

### 4.0 Teaching methods

A combination of lectures and tutorials.

### 5.0 Assessment

Assessment of this module is by examination only.

### 6.0 Recommended textbooks

Category as defined by Central Library: C = Core, S = Supplementary

<table>
<thead>
<tr>
<th></th>
<th>MacMahon and Mein: Reservoir Capacity and Yield</th>
<th>David Chin: Water Resources Engineering</th>
</tr>
</thead>
<tbody>
<tr>
<td>S</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### 7.0 Subject threads

The table below shows how the themes of design, sustainability and health & safety risk management are embedded in the curriculum (as defined by the JBM degree guidelines).

Key: Primary (P), Secondary (S) and Contributory (C).

<table>
<thead>
<tr>
<th>Design</th>
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<th>Sustainability</th>
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</thead>
<tbody>
<tr>
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</tbody>
</table>
CI9-EE-27 Water Supply and Distribution Systems

<table>
<thead>
<tr>
<th>Course leader:</th>
<th>Dr Ivan Stoianov</th>
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</thead>
<tbody>
<tr>
<td>Other contributors:</td>
<td>Industry experts (Bristol Water, Cla-Val)</td>
</tr>
<tr>
<td>Module status:</td>
<td>Core H2UM</td>
</tr>
<tr>
<td>Pre- or co-requisites:</td>
<td>CI9-EE-13, CI9-EE-07</td>
</tr>
<tr>
<td>Term:</td>
<td>Spring</td>
</tr>
<tr>
<td>Contact hours:</td>
<td>18</td>
</tr>
<tr>
<td>ECTS units:</td>
<td>3</td>
</tr>
<tr>
<td>FHEQ Level:</td>
<td>7</td>
</tr>
<tr>
<td>Assessment:</td>
<td>Written examination and Coursework</td>
</tr>
</tbody>
</table>

1.0 Aims

- To provide an understanding of the operation, modelling and control of water supply systems to ensure their resilient operation in a changing world.
- Water distribution systems are large scale infrastructure which is complex, difficult to characterise and control, and subjected to infrastructure aging, deterioration, water quality degradation and capacity shortages. Nearly 60% of the world population will soon be urban dwellers. This exploding urban population growth creates unprecedented challenges, among which the provision of clean water and sanitation have been the most pressing and painfully felt when lacking.

2.0 Syllabus

The course will start with the fundamentals of water distribution hydraulics and then proceed with modelling and analysis applications that consider both the system hydraulics and water quality. The course brings together both theoretical and practical methods and information to effectively model, analyse and optimise the operation of water supply systems.

Areas covered include:

- Management of Demand and Water Loss.
- Pumps and Pumping Stations.
- Water Distribution Networks and Service Storage.
- Modelling and Operational Control: Hydraulic and water quality.
- Informatic Support to Water Distribution Systems.
<table>
<thead>
<tr>
<th>Week No.</th>
<th>Topic</th>
<th>Staff</th>
</tr>
</thead>
<tbody>
<tr>
<td>16</td>
<td>Water Supply Systems: Introduction</td>
<td>Dr I. Stoianov</td>
</tr>
<tr>
<td>17</td>
<td>Hydraulic Principles</td>
<td>Dr I. Stoianov</td>
</tr>
<tr>
<td>18</td>
<td>Network Components &amp; Systems</td>
<td>Dr I. Stoianov</td>
</tr>
<tr>
<td>19</td>
<td>Network Modelling – Part I</td>
<td>Dr I. Stoianov</td>
</tr>
<tr>
<td>20</td>
<td>Network Modelling – Part II</td>
<td>Dr I. Stoianov, External Industry Expert</td>
</tr>
<tr>
<td>21</td>
<td>Pumps &amp; Pumping Stations</td>
<td>Dr I. Stoianov</td>
</tr>
<tr>
<td>22</td>
<td>Water Losses &amp; Pressure Management</td>
<td>Dr I. Stoianov, External Industry Expert</td>
</tr>
<tr>
<td>23</td>
<td>Water Quality Modelling</td>
<td>Dr I. Stoianov</td>
</tr>
<tr>
<td>24</td>
<td>Hydraulic Transients</td>
<td>Dr I. Stoianov</td>
</tr>
</tbody>
</table>

### 3.0 Intended learning outcomes

On successfully completing this course unit, students will be able to:

- Appreciate the economic and organisational context relating to water supply, and water utilities in general.
- Understand the key components of a water supply system.
- Gain understanding of methods to assess and reduce water loss (including optimal pressure control).
- Understand the operation of pumps, and the basis for designing pumping stations and service reservoirs.
- Be familiar with the state of art in water distribution systems hydraulic and water quality modelling and optimisation.
- Gain insight into basic and advanced concepts of solving complex hydraulic and water quality problems in water distribution systems.
- Carry out basic design calculations to specify the selection of pumps and the design of service reservoirs.
- Carry out calculations to estimate demand and design flows.
- Carry out calculations for the optimal design of water distribution networks.
- Model the hydraulic and water quality conditions in water supply networks (linear programming methods using Matlab).
- Gain familiarity with the use of modelling software packages (EPANET and Infoworks WS).
- Solve complex hydraulic and water quality problems to optimise the performance of a water distribution system.

### 4.0 Teaching methods

A combination of lectures and tutorials.
5.0 Assessment

Assessment of the module is by a combination of examination and coursework.

6.0 Recommended textbooks

Category as defined by Central Library:

C = Core, S = Supplementary

<table>
<thead>
<tr>
<th></th>
<th>Water Supply</th>
<th>Hydraulics in Civil and Environmental Engineering</th>
<th>Water Distribution Systems</th>
<th>Drinking water: principles and practices</th>
</tr>
</thead>
</table>

7.0 Subject threads

The table below shows how the themes of design, sustainability and health & safety risk management are embedded in the curriculum (as defined by the JBM degree guidelines).

Key: Primary (P), Secondary (S) and Contributory (C).

<table>
<thead>
<tr>
<th>Design</th>
<th>Health &amp; Safety Risk Management</th>
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</tr>
</thead>
<tbody>
<tr>
<td>S</td>
<td>-</td>
<td>C</td>
</tr>
</tbody>
</table>
CI9-EE-28 Water and Wastewater Treatment

Course leader: Professor Nigel Graham

Other contributors: Dr Michael Templeton, Professor Stephen Smith

Module status: Core H2UM

Pre- or co-requisites: 

Term: Spring

ECTS units: 3

FHEQ Level: 7

Assessment: Written examination

1.0 Aims

- To provide a basic description and understanding of the principal unit processes used in the treatment of drinking water and municipal wastewaters.
- This will include coverage of the scientific basis of each unit process, as well as the conventional approach to their engineering design. By reviewing the variety of raw water qualities commonly found, and the prevailing drinking water quality standards that must be compiled with, the course will highlight and detail the typical configurations of unit processes used in the UK and internationally.
- In the area of wastewater treatment the course will aim to provide an understanding of the kinetic theory of biological growth and apply it to typical aerobic processes, and an appreciation of the purpose and practice of sludge treatment.

2.0 Syllabus

- Drinking water treatment including: introduction to water treatment; coagulation; floc separation processes; filtration; disinfection.
- Wastewater treatment including: introduction to wastewater treatment; sedimentation; biological treatment - activated sludge; biological treatment – biofiltration; sludge treatment and dewatering.

<table>
<thead>
<tr>
<th>Week No.</th>
<th>Topic</th>
<th>Staff</th>
</tr>
</thead>
<tbody>
<tr>
<td>16</td>
<td>Introduction to water treatment</td>
<td>Professor N. Graham</td>
</tr>
<tr>
<td>17</td>
<td>Introduction to wastewater treatment</td>
<td>Dr M. Templeton</td>
</tr>
<tr>
<td>18</td>
<td>Coagulation</td>
<td>Professor N. Graham</td>
</tr>
<tr>
<td>19</td>
<td>Sedimentation</td>
<td>Dr M. Templeton</td>
</tr>
<tr>
<td>20</td>
<td>Floc separation processes</td>
<td>Professor N. Graham</td>
</tr>
<tr>
<td>21</td>
<td>Activated sludge and biofiltration</td>
<td>Dr M. Templeton</td>
</tr>
<tr>
<td>22</td>
<td>Filtration</td>
<td>Professor N. Graham</td>
</tr>
<tr>
<td>23</td>
<td>Disinfection</td>
<td>Professor N. Graham</td>
</tr>
<tr>
<td>24</td>
<td>Sludge treatment and dewatering</td>
<td>Professor S. R. Smith</td>
</tr>
</tbody>
</table>
3.0 **Intended learning outcomes**

On successfully completing this course unit, students will be able to:

- Appreciate how the nature of source waters and raw wastewaters, and treatment objectives influence the type, number and sequence of unit processes.
- Understand the fundamental, scientific basis governing the design and performance of the treatment technologies reviewed in the module.
- Understand the role of each unit process within typical treatment process trains, their interaction and the context of when they are applied. Define an appropriate process stream for the treatment of a typical raw/source water and a wastewater, and the main secondary flows from the treatment.
- Apply their knowledge of the principles of water and wastewater treatment to the design of each unit process reviewed in the module.
- Become familiar with the terminology applied to water and wastewater treatment processes and the key design parameters, units and common figures of merit.

4.0 **Teaching methods**

The module is delivered in the spring term as a set of 18 lectures and includes a number of tutorial exercises. The content of the module is complemented by site visits to treatment plants during the study tour at the end of the term.

5.0 **Assessment**

Assessment of the module is by examination.

6.0 **Recommended textbooks**

Category as defined by Central Library:

7.0 Subject threads

The table below shows how the themes of design, sustainability and health & safety risk management are embedded in the curriculum (as defined by the JBM degree guidelines).

Key: Primary (P), Secondary (S) and Contributory (C).

<table>
<thead>
<tr>
<th>Design</th>
<th>Health &amp; Safety Risk Management</th>
<th>Sustainability</th>
</tr>
</thead>
<tbody>
<tr>
<td>S</td>
<td>-</td>
<td>S</td>
</tr>
</tbody>
</table>


1.0 Aims

- To understand the role of containment engineering in the protection of public health and the environment.
- The focus is on the issues associated with waste containment technologies including landfill as this remains the dominant waste disposal method used world-wide.
- To introduce waste degradation processes and the geological aspects of landfill design required to limit potential environmental impacts.
- To discuss the significant problems associated with mining tailings dam.
- To understand the properties of liners, landfill site hydrogeology, gas control and monitoring. The course includes a group case study on a detailed landfill design.

2.0 Syllabus

<table>
<thead>
<tr>
<th>No.</th>
<th>Topic</th>
<th>Staff</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>Introduction to waste management and landfill</td>
<td>Professor C. Cheeseman</td>
</tr>
<tr>
<td>02</td>
<td>Chemistry and biology of waste decomposition processes</td>
<td>Professor C. Cheeseman</td>
</tr>
<tr>
<td>03</td>
<td>Use of geosynthetics for sustainable development</td>
<td>Dr R. Jones</td>
</tr>
<tr>
<td>04</td>
<td>Barrier system performance</td>
<td>Dr R. Jones</td>
</tr>
<tr>
<td>05</td>
<td>Geosynthetic liners and slope stability</td>
<td>Dr R. Jones</td>
</tr>
<tr>
<td>06</td>
<td>Containment engineering: industrial case studies</td>
<td>Joe Jackson</td>
</tr>
<tr>
<td>07</td>
<td>Material liners and construction quality assurance</td>
<td>Dr R. Jones</td>
</tr>
<tr>
<td>08</td>
<td>Mining Tailings Dams</td>
<td>Roger White</td>
</tr>
<tr>
<td>09</td>
<td>Project presentations</td>
<td>Dr R. Jones \ Dr C. Cheeseman</td>
</tr>
</tbody>
</table>
3.0 Intended learning outcomes

On successfully completing this course unit, students will be able to:

- Have an excellent appreciation of the general issues associated with containment engineering and particularly a detailed understanding of all aspects associated with engineering landfill sites.

4.0 Teaching methods

The content is delivered primarily through lectures. There is also a piece of coursework set – the focus of which is on the design of a landfill. This involves students working in small groups, and each group is required to give a short presentation.

5.0 Assessment

The assessment of the module is by a combination of examination and coursework.

6.0 Recommended textbooks

Category as defined by Central Library:

C = Core, S = Supplementary

| S | Comprehensive lecture notes are provided, together with various codes and guidance notes. |

7.0 Subject threads

The table below shows how the themes of design, sustainability and health & safety risk management are embedded in the curriculum (as defined by the JBM degree guidelines).

Key: Primary (P), Secondary (S) and Contributory (C).

<table>
<thead>
<tr>
<th>Design</th>
<th>Health &amp; Safety Risk Management</th>
<th>Sustainability</th>
</tr>
</thead>
<tbody>
<tr>
<td>P</td>
<td>C</td>
<td>S</td>
</tr>
</tbody>
</table>
CI9-EE-30 Water Quality Engineering and Ecohydrology

<table>
<thead>
<tr>
<th>Course leader:</th>
<th>Dr Wouter Buytaert</th>
</tr>
</thead>
</table>
| Other contributors: | Mr Mike Dunbar, Environment Agency  
| | Professor Stefan Krause, University of Birmingham |
| Module status: | Core H2UP |
| Pre- or co-requisites: | |
| Term: | Spring |
| Contact hours: | 18 |
| ECTS units: | 3 |
| FHEQ Level: | 7 |
| Assessment: | Written examination |

1.0 Aims

- To introduce water quality issues, and the basic concepts of surface water quality assessment, modelling and engineering. Models of pollution transport are described.
- To cover methods of modelling organic pollution, nutrients, toxins and sediment quality in rivers and lakes. Through a combination of lectures and practical sessions, dynamic models of river and lake water quality are described and developed.
- Students are taught how to develop their own models, and are introduced into how models are used in practice.
- The course concludes with two lectures on catchment water quality management and two on hydroecology.

2.0 Syllabus

- The course is delivered in the spring term as a set of 20 lectures and includes seminar/revision periods as tutorial support.

<table>
<thead>
<tr>
<th>No.</th>
<th>Topic</th>
<th>Staff</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>Introduction and concepts</td>
<td>Dr W. Buytaert</td>
</tr>
<tr>
<td>02</td>
<td>Fundamentals of fate and transport</td>
<td>Dr W. Buytaert</td>
</tr>
<tr>
<td>03</td>
<td>Rivers</td>
<td>Dr W. Buytaert</td>
</tr>
<tr>
<td>04</td>
<td>Lakes and reservoirs (1)</td>
<td>Dr W. Buytaert</td>
</tr>
<tr>
<td>05</td>
<td>Lakes and reservoirs (2)</td>
<td>Dr W. Buytaert</td>
</tr>
<tr>
<td>06</td>
<td>Ecotoxicology</td>
<td>Dr W. Buytaert</td>
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<td>07</td>
<td>Watershed management</td>
<td>Professor S. Krause</td>
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<td>08</td>
<td>Hydroecology 1</td>
<td>Mike Dunbar</td>
</tr>
<tr>
<td>09</td>
<td>Hydroecology 2</td>
<td>Mike Dunbar</td>
</tr>
</tbody>
</table>
3.0 Intended learning outcomes

On successfully completing this course unit, students will be able to:

- Understand the context of water quality management and engineering.
- Apply mass balance principles to develop and solve simple water quality models.
- Incorporate in models the processes of: pollutant decay and sedimentation, sorption and desorption, oxygenation, respiration and photosynthesis.
- Understand eutrophication: the principal biochemical and physical factors affecting algae growth, management problems and solutions, and modelling approaches and their limitations.
- Understand acidification: the principal biochemical and physical factors affecting acidification, management problems and solutions, and modelling approaches and their limitations.
- Understand the reasons for and approaches to constructing a catchment water quality model.
- Understand the diffuse pollution management challenge and the role of modelling.
- Understand the main factors affecting habitat quality in a stream, and some methods of assessing habitat quality, and possible solutions to habitat quality problems.
- Solve a range of simple water quality problems by building and applying water quality models.
- Recognise the links between water quality engineering and management, and the theories and practices taught in other related modules in this MSc (e.g. flood hydrology, groundwater flow and quality, fluid mechanics).

4.0 Teaching methods

The module is delivered through a combination of lectures, invited lectures, and tutorials.

5.0 Assessment

Assessment of the module is by examination.

6.0 Recommended textbooks

Category as defined by Central Library:

<table>
<thead>
<tr>
<th></th>
<th>Core (C)</th>
<th>Supplementary (S)</th>
</tr>
</thead>
<tbody>
<tr>
<td>S</td>
<td>Surface water quality modelling, by S. Chapra, McGraw-Hill.</td>
<td></td>
</tr>
</tbody>
</table>
### Subject threads

The table below shows how the themes of design, sustainability and health & safety risk management are embedded in the curriculum (as defined by the JBM degree guidelines).

Key: Primary (P), Secondary (S) and Contributory (C).

<table>
<thead>
<tr>
<th>Design</th>
<th>Health &amp; Safety Risk Management</th>
<th>Sustainability</th>
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<tbody>
<tr>
<td>S</td>
<td>-</td>
<td>C</td>
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</table>
CI9-EE-31 Research Dissertation

<table>
<thead>
<tr>
<th>Course leader:</th>
<th>Professor Sue Grimes (EE Cluster); Dr Adrian Butler (Hydrology Cluster)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Other contributors:</td>
<td></td>
</tr>
<tr>
<td>Module status:</td>
<td>Core H2UM, H2UP</td>
</tr>
<tr>
<td>Pre- or co-requisites:</td>
<td>Completion of taught programme (full time students)</td>
</tr>
<tr>
<td>Term:</td>
<td>Summer</td>
</tr>
<tr>
<td>Contact hours:</td>
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<td>ECTS units:</td>
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</tr>
<tr>
<td>FHEQ Level:</td>
<td>7</td>
</tr>
<tr>
<td>Assessment:</td>
<td>Coursework</td>
</tr>
</tbody>
</table>

1.0 Aims

The aim of the Research Dissertation is to undertake a specific piece of independent research in the form of a critical review, a laboratory- or field-based experimental investigation, or a modelling/numerical analysis project.

2.0 Syllabus

Students will be required to work full-time on their Research Dissertation commencing in the summer term immediately following completion of the MSc examinations through to the end of August (a date to be advised). Students may either propose their own topic for research or choose from a list of topics provided by staff. Research projects will differ in their area of focus, but their role is to challenge the student to complete an independent piece of research under the direct supervision of a member of academic staff and may involve supervision from external parties.

As part of the Induction programme for the Individual Research Project students will receive training in (i) Health and Safety and Risk Assessment, and (ii) Research Information Skills including:

- Interpretation of the literature.
- Database searching.
- Referencing.
- Practical tools for database strategy and Refworks.
- Use of Turnitin.
The output from the research is in two forms:

(i) A Research Paper: which is limited to 12,000 words maximum should be written in English, in 12point font, 1.5 line spacing and margins should be 25mm. **NOTE: 12,000 words includes abstract, text and captions to figures and tables and NOT references, appendices.**

The Research Paper should include an abstract, evidence of a literature review setting the context of the research, a clear statement of aims and objectives, and the methodology applied, results and discussion, conclusions and recommendations, and references. Appendices may be used to contain additional supplementary information. The use of figures (graphical images, photographs and other forms of illustration) and tables in presentation of the research is encouraged as these can convey the context of a message visually and provide a relief from large amounts of heavy text, and, at the same time, do not contribute to the word count. Common sense should be applied in terms of achieving the appropriate balance of text vs other forms of presentation. Students are advised to discuss the detail and nature of the format of their dissertation with their supervisor.

(ii) A Poster presentation: which describes the project and the research findings in a visual and graphical manner and will be viewed by members of staff, industry sponsors and the External Examiner, at a Poster event on the day before the Board of Examiners Meeting in September of the year of submission. Details of poster presentations will be provided separately.

3.0 Intended learning outcomes

The Research Dissertation provides students with the opportunity to demonstrate:

- A unique contribution to an area of research interest.
- Originality/creativity, critical analysis, investigation and understanding.
- Effective communication, writing and presentation skills.
- Skills in project and time management as well as management of expectations in delivery.
- Ability to defend research outputs through a poster presentation.

Furthermore the Research Dissertation provides students with additional skills in technical writing through the preparation of a scientific Research Paper, which could form the basis of a manuscript for submission for peer-reviewed publication, and places candidates in a highly marketable position in terms of recruitment and career progression.
4.0 Teaching methods

The module will be delivered through a suite of introductory lectures on research methods and related material of importance to undertaking a research project, with students spending the remainder of the time working independently on their projects to meet the research aims and objectives (under staff supervision, with possible support from PDRA and PhD researchers). Where appropriate, students will be trained in experimental methods, use of analytical techniques, specialist software and computational tools.

5.0 Assessment

The Research Dissertation is assessed by a minimum of two members of staff, and marked against a set of criteria based around the definition of the research problem, evidence of application, initiative and effort, originality, analysis and discussion of results, and clarity of presentation. The mark for the Research Dissertation represents 40% of the overall MSc result.

6.0 Recommended textbooks

Category as defined by Central Library:

C = Core, S = Supplementary

- None recommended.

7.0 Subject threads

JBM Subject and Threads Matrices (table). Includes: ECTS value per module, Threads (Design, Health & Safety Risk Management, and Sustainability) and whether they are a primary, secondary or contributory outcome for each module.

**Keys:**
P = Primary Outcomes
S = Secondary Outcomes
C = Contributory

<table>
<thead>
<tr>
<th>Sustainability</th>
<th>Health &amp; Safety Risk Management</th>
<th>Design</th>
</tr>
</thead>
<tbody>
<tr>
<td>S</td>
<td>C</td>
<td>C</td>
</tr>
</tbody>
</table>
1.0 Aims

- To be able to understand topics including the different reasons why farmers irrigate in the developed world and in developing countries, how irrigation can be a powerful tool for poverty alleviation and food security, the technologies for getting water from a source to crops, methods of water application on-farm (surface, sprinkler, drip and irrigation), irrigation management including irrigation scheduling methods on-farm and on irrigation schemes, the current trends toward irrigation management transfer from government to farmers and the growth of water user groups that encourage farmers to take responsibility for water management.

- To understand the concept of efficiency, and the question of, “does efficiency really matter will also be raised in situations where water is in short supply?” The role of drainage in irrigation design and management will be discussed together with techniques of drainage design. Problems of salinisation are reviewed and methods for management and remediation of salinity problems.

2.0 Syllabus

The syllabus is designed to include the following topics:

- Introduction to irrigation planning, design and management.
- Getting water from source to crops.
- Methods of irrigation on-farm.
- Irrigation management on-farm and in the main systems.
- Design of a sprinkler system.
- Drainage Design.
- Salinity Control and Remediation.
- Impacts of agricultural practice on water quality, especially nutrients.
- Examples of irrigation impacts on groundwater depletion.
3.0 Intended learning outcomes

3.1 Knowledge and Understanding Skills

On successfully completing this core module, students will be able to:

- Calculate irrigation volume and scheduling requirements of different types of crops in different climates.
- Comment on the relative merits of different methods of irrigation.
- Discuss the role of irrigation in poverty alleviation and food security, and how irrigators can contribute to responsible water management.
- Understand the criteria affecting drainage design and hence design simple drainage systems.
- Understand the problem of salinisation and potential solutions.
- Appreciate the impact of agriculture on water quality.

3.2 Practical and Transferable Skills

On successfully completing this core module, students will be able to:

- Design simple irrigation, drainage and salinity management schemes.
- See the links between irrigation and farm drainage problems and other related aspects of the MSc (e.g. fluid mechanics, hydrological processes, environmental management in developing countries).

4.0 Teaching methods

This module will be taught through a series of lectures.

5.0 Assessment

Assessment of the module is by coursework.
6.0 Recommended textbooks

Category as defined by Central Library:
C = core, S = supplementary

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<td>S</td>
<td>Kay M (1986) Surface Irrigation, Cranfield Press, Bedford, 142pp</td>
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7.0 Subject threads

The table below shows how the themes of design, sustainability and health & safety risk management are embedded in the curriculum (as defined by the JBM degree guidelines).

Key: Primary (P), Secondary (S) and Contributory (C).

<table>
<thead>
<tr>
<th>Analysis</th>
<th>Health &amp; Safety Risk Management</th>
<th>Sustainability</th>
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