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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 340 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 2016) 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.
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 opportunities 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 (see page 6 for more information).

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 (see page 6).

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 3-minute thesis 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.
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)
1. Introduction to the Department

Welcome from the Head of Department

A warm welcome to you all. I trust you have had a great summer (or winter for those of you from the southern hemisphere) and I hope that you are now ready to study again. 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 and we don’t intend to allow Brexit, or any other outside influence, change that. London is a wonderful place to be a student. Please take full advantage of your once in a lifetime opportunity and strike 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 Programme Director

On behalf of all staff involved in the delivery of the MSc courses in Advanced Structural Engineering I am pleased to welcome you all to Imperial College. I hope that the 2016-2017 academic year is one that you will look back upon with a great sense of pride and achievement.

We are proud of the history that our Section can boast of and the contributions that we have made, and continue to make, to our industry over the past decades. You are a part of that legacy now and I look forward to seeing the role you play in this ongoing narrative.

The sense of achievement you will feel upon completion will reflect the fact that the coming months will be demanding. Some of you will find the course more demanding than others, but all of you will be tested. You are fortunate to have access to world class resources, both in terms of the library and computational facilities as well as the calibre of the academic and support staff within the Section. I sincerely hope that you make the most of these resources while you are with us.

London is an incredible, vibrant city, and a wonderful place to live and study. I encourage you to experience life in London and to allow the energy of the city to invigorate your studies.

I look forward to interacting with you all in due course, and look forward to seeing what you all achieve this year.

Dr Peter J Stafford
<table>
<thead>
<tr>
<th>Academic and administrative staff</th>
</tr>
</thead>
</table>
| **Ruth Bello**  
Structures Section Group Administrator  
Room 439  
020 7594 6040  
r.bello@imperial.ac.uk |
| **Professor Nick Buenfeld**  
Professor of Concrete Structures and Head of Department  
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| **Professor Ahmed Elghazouli**  
Professor of Structural Engineering and Head of Section  
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<thead>
<tr>
<th>Name</th>
<th>Position</th>
<th>Room</th>
<th>Phone</th>
<th>Email</th>
</tr>
</thead>
<tbody>
<tr>
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<tr>
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</tr>
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</tr>
</tbody>
</table>
English language requirement

If you are not a native English speaker you must meet the College’s English language requirements.

See the Admissions website for details:

www.imperial.ac.uk/study/pg/apply/requirements/english

For information on English language support available while you’re here, see page 43.

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.

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 2016–17

Term dates

<table>
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<tr>
<th>Term</th>
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<tr>
<td>Autumn term</td>
<td>1 October–16 December 2016</td>
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<tr>
<td>Spring term</td>
<td>7 January–24 March 2016</td>
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<tr>
<td>Summer term</td>
<td>29 April–30 June 2016</td>
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**Closure dates**

- Christmas/New year: 24 December 2016–02 January 2017
- Easter holiday: 12 April–18 April 2017
- Early May bank holiday: 01 May 2017
- Spring bank holiday: 29 May 2017
- Summer bank holiday: 28 August 2017

**Programme dates**

- Written examinations (date commencing): 18 December 2016
  - 09 January 2017
  - 01 May 2017
- Project hand-in: 09 January–late August 2017
- Board of Examiners meeting: Mid-September 2017
- End of course: 30 September 2017

**Key events**

- Postgraduate Awards Ceremonies: 03 May 2017 (tbc)
- Imperial Festival and Alumni Festival: 6–7 May 2017
2. Programme information

Imperial Mobile app

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

www.imperial.ac.uk/imperialmobile

Programme overview

The courses consist of a number of core subjects and elective modules which are taken in the first two terms. All core courses must be taken, in addition to electives in both taught terms, to a total of 12 modules in completion of the programmes. For certain spring term modules, a related module in autumn term may be a prerequisite. The electives enable students to develop a primary study theme (e.g. advanced structural analysis, concrete materials and structural assessment or seismic design of concrete structures). The courses attach considerable importance to both advanced structural analysis and theoretical concepts in structural engineering as well as fundamental and applied concepts related to structural design.

In the final months of the courses, all students undertake one two-week conceptual design project in a group environment before completing a major investigative research dissertation, or a major detailed design oriented project (both of which are individual submissions).

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

- To 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.
- To enable students to acquire a mature appreciation of the context in which engineering projects are developed within the industry.
- To develop our students’ excellence in oral, written and graphical communication.
- To provide students with sufficient material to explore and study the subject, in preparation for professional practice.
- To provide the basis for the recognition and understanding of the major features of structural engineering.
- To develop an understanding of how this knowledge may be applied in practice in an economic and environmentally sustainable manner.
- To foster the acquisition and implementation of broad research and analytical skills related to structural engineering.
- To attract highly motivated students irrespective of race, gender, background and physical disability, from the UK and overseas.
- To develop new areas of teaching in response to the advance of scholarship and the needs of the community including vocational training.
- To provide an introduction to the subject for students from other relevant and numerate disciplines.
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 typically involve:

- One day per week over three years.
- Term release (taken part time on a term-by-term basis, over three years).
  - Year 1: Autumn term
  - Year 2: Fallow (or just project)
  - Year 3: Spring term and project

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 Institution of Civil Engineers (ICE)

Apply for graduate membership if you already have a degree in Civil Engineering:

https://www.ice.org.uk/membership/grades-of-ice-membership/graduate-membership

The Institution of Structural Engineers (IStructE)

https://skempton.wufoo.com/forms/q7x2x3/

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 back 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**

The standard penalty is 5% per day absolute mark reduction.


**Professional skills development**

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 Advanced Structural Engineering module descriptors can be found on the following link:

[http://www.imperial.ac.uk/civil-engineering/prospective-students/postgraduate-taught-admissions/advanced-structural-engineering-cluster/syllabus/](http://www.imperial.ac.uk/civil-engineering/prospective-students/postgraduate-taught-admissions/advanced-structural-engineering-cluster/syllabus/)

**Deadlines for choosing elective modules**

The deadline for choosing your autumn term elective modules is Thursday, week 3.

The deadline for choosing your spring term elective modules is Thursday, week 18.
**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](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/](http://www.imperial.ac.uk/careers/)

- The transferable skills training programme run by the Graduate School.

  [http://www3.imperial.ac.uk/graduateschools/](http://www3.imperial.ac.uk/graduateschools/)

- 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:

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

  - 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 and accessing iCal**

You will receive details of your timetable in advance, during the first days of the new term.

All students, once subscribed to the timetabling database, will receive a subscription email.
Use the link below to view your timetable on your device’s calendar. This will automatically subscribe you to “My Timetable”, showing your lectures, classes and other scheduled events.

webcal://www.imperial.ac.uk/timetabling/mytimetable/ical/AL3KAXRE287701/schedule.ics

**Re-examinees right to attend.**

There is no right to re-attend. Access to the Blackboard Lean VLE, and College computing accounts, will be retained.

**Research dissertations and design projects**

Undertaken over the final four months of the course, you will aim to complete either:

- One group-based conceptual design project and a detailed individual design project
- One group-based conceptual design project and a research-orientated dissertation.

The principle aim of the Design Project/Research Dissertation is to assess the capability of students to undertake independent research-based work.

<table>
<thead>
<tr>
<th>Total Marks Allocated</th>
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<tr>
<td>Conceptual Project</td>
<td>30</td>
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<tr>
<td>Detailed Project or Dissertation</td>
<td>270</td>
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**Topics**

**Dissertations:** a list of dissertation topics will be released towards the end of the spring term with information on the selection process. Students are also encouraged to propose their own topics, in consultation with members of the teaching staff.

**Design Project:** as with dissertations, selection of the detailed design projects is towards the end of the spring term. The projects are:

- Tall Building Project
- Bridge Project
- Concrete Building Project

Further information on Dissertations and Design Projects (Conceptual and Detailed) including pre-requisite modules, are available from the following: [CI9-STR-18 Design Projects - Dissertation](#)

**Supervision arrangements**

The nature of supervision that you will receive over the summer term varies depending upon whether you undertake a detailed design project or a research dissertation. In the former case a lead academic, often with support from industry, runs group tutorial sessions over the first six weeks of the projects. At these sessions, all students undertaking a particular design project receive information and feedback on their progress. In the case of undertaking a research dissertation you will receive one-to-one support from a member of academic staff. The particular arrangement in this case depend upon the nature of the dissertation topic and the preferences of the academic.
Personal tutors and term reports (MSc students)

Structures MSc students are assigned a Personal Tutor from the academic staff. Personal Tutors provide a source of support to their tutees, both pastoral and academic. Your Personal Tutor will take an interest in your academic and professional development, and you can discuss any issues and turn to them for advice and help.

While in the Department, you are expected to submit an autumn term and a spring term report each academic year on your progress which you are required to discuss with your Personal Tutor. You are expected to complete the term reports for the following purposes:

- To keep a record of your academic progress.
- To keep a record of any health or other problems that you may encounter.
- To follow your professional development.
- To be informed of your outside interests and activities, which we consider part of your life at College.

Your term reports:

- Will be used as a check-point on attendance
- To advise the Board of Examiners of any circumstances to be considered in mitigation in individual cases.
- Your Personal Tutor is likely to act as a future referee on your behalf, you should therefore make and maintain contact with this as necessary. The attached form need only be submitted once per term, but you should make appointments to see your Tutor as required.

A timetabled slot at the end of each term will be set for you to meet your Personal Tutor to review and sign your term reports. If your timetabled slot is inconvenient for your or your Personal Tutor, please contact your tutor to rearrange.

You can obtain the templates of the term reports including the Guidance Notes from Blackboard Learn. We take note of sickness and absences and any other problems that you are encountering during the session and we sometimes pick these up in your term reports.

Further information on term reports including where to find them and submission dates will be provided by your Cluster Administrator.

MSc Structures Cluster You will be assigned a Personal Tutor within the first week of term.

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

Once available, the revised programme specification 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, and may be restricted, in particular for those students under Tier 4 Visa restrictions.

Ruth Bello
Room 439
r.bello@imperial.ac.uk
3. Assessment

The Advanced Structural Engineering cluster assessments comprise two elements: examinations-coursework combined and projects (projects comprise Conceptual Design, Detailed Design and/or the Research Dissertation. Successful candidates will be awarded the MSc degree of Imperial College London and the Diploma of Imperial College (DIC).

The Advanced Structural Engineering cluster assessments comprise individual and group coursework submissions; projects and presentations; written and oral examinations and a research dissertation or detailed design project. To complete the requirements of the degree, all assessments must be undertaken to the appropriate level.

The elements above also apply to those taking Business Management or Sustainable Development (Sustainable Development is suspended for entry in academic year 2016-17), in which examinations and coursework results will be integrated into the overall examination and coursework elements. Please note that both Business Management and Sustainable Development will be suspended for entry in academic year 2017-18.

Progression

Where a mark below 40% in an individual component is presented, the student is then permitted to re-take that element (normally by written examination paper) at the next opportunity, which is typically in the following year. Where the overall performance is below 50%, the student is permitted to re-enter for the elements of assessment in question, but not to attend or to progress to a subsequent year.

Students not attending or progressing to the satisfaction of the Programme Director during the term, a note of warning may be issued to him/her. This is called a “six-week warning” and is the equivalent to notice of withdrawal.

This may result in:

- (For Via-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 normally permitted to progress to a subsequent year, provided that their average performance is in excess of 50%.

Criteria for the award of the degree

The MSc degree is awarded to any student who achieves all of the following:

1. An aggregate mark of 50% minimum in all examinations and associated coursework, AND
2. A mark of 50% minimum in the major project or dissertation, including the Conceptual Design Project.
3. In line with the policy on assessment of advanced postgraduate courses provided by Imperial College London, no compensation will be given in assessments in which a candidate has achieved less than 40% in one or more of the examination papers.

Provided that all three of the above criteria are satisfied, the MSc degree will be awarded in one of the following classifications:
(a) Pass (see above), or
(b) Pass with Merit would normally be awarded if the aggregate mark of all examinations and
associated coursework is not less than 60% AND the mark for the dissertation is not less
than 60% AND the MSc is completed in 12 months, or
(c) Pass with Distinction would normally be awarded if the aggregate mark for the
examinations and associated coursework is not less than 70% AND the mark for the
dissertation is not less than 70% AND the MSc is completed in 12 months.

Past examination papers
Most academics will make available past examination papers and model answers to the Blackboard
Learn VLE, or will work through example examination questions during tutorial sessions.

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:

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

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 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 as this can be smudged by you or the person marking the paper.
- 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 5-10 minutes 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:** 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

Plagiarism is the presentation of another person’s thoughts, words, images or diagrams as though they were your own. Another form of plagiarism is self-plagiarism, which involves using your own prior work without acknowledging its reuse.

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.

Where plagiarism is detected in group work, members of that group may be deemed to have collective responsibility for the integrity of work submitted by that group and may be liable for any penalty imposed, proportionate to their contribution.

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, and
- Copying the work of another student without their knowledge (please also see “Passing coursework to others to submit” below)
- Dissertation/Major Project.
- Where the student does not admit that plagiarism has occurred, and that the plagiarism offence is upheld on appeal.

Collusion

You must not, unless expressly authorised, pass any information from another student during an examination or when completing coursework. You are not permitted to act in collusion with another student or person, nor are you permitted to copy from another student, or engage in any similar activity.

Minor penalties apply.

Passing coursework for others to submit

You are not permitted to request or arrange for another individual to submit your coursework for you. You should make every effort to ensure that you are available to submit your coursework in person. Should circumstances prevent you from handing in your own coursework, you should inform your Cluster Administrator and the lecturer concerned at the earliest opportunity to devise an alternative arrangement.

Minor or Major penalties may apply.

In order to assist you in the avoidance of plagiarism, and to enhance good academic practice, we provide support and resources in the form of online and in-person training courses, all of which are compulsory. You are also free to approach staff at any time for advice, in particular our Library staff. More detail is provided below.

Penalties

Minor plagiarism:

- The mark awarded be reduced by one or more grade boundaries (increments of 10%) or that the mark awarded by reduced to zero;
- That a note of reprimand be included in your file relating to this allegation, finding, recommendation and action taken, to be removed at the end of the academic year;
- That no reference letters, or other indicators of progress, will be provided to you while the note of reprimand remains on your file;
- That an anonymous report be made to the Board of Examiners and the College Registry relating to this allegation, finding, recommendation and action taken;
- That you undertake a one-to-one session re. Plagiarism and good academic practice with a trained member of the Library Staff, which we will set in place.

Major plagiarism:
The following (Tariffs 3 (a), (b), (c) and 4) are extracted from Annex I (pages 11-13) of the College’s Cheating Offences Policy and Procedures document:


- That the candidate is to be formally reprimanded, that zero is to be recorded for the performance of the candidate in all the written examinations and other assessments s/he sat in the academic year the offence occurred and that the candidate not be permitted to retake the assessments in that academic year; and
  - That the candidate, where eligible, should retake the assessments at the next available opportunity, but the mark recorded will be ‘capped’ at the pass-mark; or
  - That the candidate is not to be permitted to re-enter for any assessments before the expiry of a stated period of time, not exceeding two years and the mark recorded will be ‘capped’ at the pass-mark; or
  - That the candidate is to be permitted to re-enter for those assessments on the next available opportunity and the mark recorded will be ‘capped’ at the pass-mark, but that no degree/diploma/certificate is to be awarded to the candidate before the expiry of a stated period, not exceeding two years following satisfactory completion of the conditions for the award;

- That the candidate is to be formally reprimanded, that zero is to be recorded for the performance of the candidate in all the written examinations and other assessments s/he sat in the academic year the offence occurred and s/he is to be excluded from any future assessments administered under the College’s jurisdiction; this amounts effectively to expulsion from the College.

Cheating offences policy and procedures
It is important that you learn how to properly attribute and acknowledge the work, data and ideas of others. Plagiarism is scientific misconduct, and students whose assessments can be shown to contain plagiarism are subject to penalties as outlined in the College’s Cheating Offences Policy and Procedures – see Appendix 3 of the Examination Regulations which can be found here:

www.imperial.ac.uk/about/governance/academic-governance/regulations

Online plagiarism course
All postgraduate students are required to take a compulsory online course in plagiarism awareness. The course is designed to provide you with guidance and information about proper citation and attribution in writing.
There is no limit to the amount of times you can take the course – it can be accessed anytime, so there will always be an opportunity to refresh your understanding. If at the end of the course, you feel that you might require additional guidance, directions will be given to alternative sources of information and advice.

http://www.imperial.ac.uk/study/pg/graduate-school/professional-skills/masters/online/

**Library training (compulsory attendance)**

The Departmental Liaison Librarian, Nicole Urquhart, will provide training to Master’s students in two phases. These are to ensure that students are aware of the tools and facilities available to them in support of their studies.

The first of these will run in weeks 4-6 and will focus on training students in the art of proper referencing and the avoidance of plagiarism. During this session students will also complete a compulsory online plagiarism awareness course.

The second session will focus on research for your dissertations and will cover the following:

- Searching for papers, reports etc. using online search tools.
- Citing and referencing using the Harvard style.
- Using RefWorks to store your references and generate bibliographies.

Nicole Urquhart

Central Library

020 7594 1889

n.urquhart@imperial.ac.uk
6. Board of examiners

Board of Examiners

CHAIR

Professor Ahmer Wadee

EXAMINATIONS OFFICER

Dr Peter Stafford

SECRETARY

Ruth Bello

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

For external examiners

Dr Spiridione Buhagiar, University of Malta

To be confirmed

It may happen that Master’s level students to have some form of academic or social interaction with their external examiners at some point during or after their studies as well as during the assessment process itself.

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 examiners reports digests can be found here:

www.imperial.ac.uk/staff/tools-and-reference/quality-assurance-enhancement/external-examining/information-for-staff
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.

Facilities

PC laboratories

The Building houses three PC laboratories located in rooms 208, 314, and 317. These facilities are open to all registered students of the Department 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.

The Civil and Environmental Engineering Department is contained in the Skempton Building. Most of 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/
<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>Examinations – tutorials – study groups</td>
</tr>
<tr>
<td>Teaching Room 064A</td>
<td>0</td>
<td>30</td>
<td>Lectures – tutorials – examinations – presentations</td>
</tr>
<tr>
<td>Teaching Room 064B</td>
<td>0</td>
<td>30</td>
<td>Lectures – tutorials – examinations – presentations</td>
</tr>
<tr>
<td>Laboratory Room 043</td>
<td>0</td>
<td>N/A</td>
<td>Hydrodynamics Laboratory</td>
</tr>
<tr>
<td>Teaching Room 163</td>
<td>1</td>
<td>40</td>
<td>Lectures – tutorials – examinations – presentations</td>
</tr>
<tr>
<td>Lecture Theatre 164</td>
<td>1</td>
<td>160</td>
<td>Lectures – presentations – seminars</td>
</tr>
<tr>
<td>Teaching Room 165</td>
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<td>22</td>
<td>Lectures – tutorials – examinations – presentations</td>
</tr>
<tr>
<td>Laboratory Room 158</td>
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<td>N/A</td>
<td>Structures Laboratory</td>
</tr>
<tr>
<td>Lecture Theatre 201</td>
<td>2</td>
<td>122</td>
<td>Lectures – presentations – seminars</td>
</tr>
<tr>
<td>Lecture Theatre 207</td>
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<td>50</td>
<td>Lectures – presentations – seminars</td>
</tr>
<tr>
<td>Munro Computing Lab 208</td>
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<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>
<td>2</td>
<td>N/A</td>
<td>Intelligent Infrastructure Transport Systems (IITS) Laboratory</td>
</tr>
<tr>
<td>Teaching Room 224</td>
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<td>60</td>
<td>Lectures – tutorials – presentations – seminars – practicals</td>
</tr>
<tr>
<td>Mezzanine Lab 240</td>
<td>2</td>
<td>N/A</td>
<td>Workshops – lab practicals – design classes</td>
</tr>
<tr>
<td>Teaching Room 301</td>
<td>3</td>
<td>92</td>
<td>Lectures – tutorials – examinations – presentations – seminars</td>
</tr>
<tr>
<td>Teaching Room 307</td>
<td>3</td>
<td>76</td>
<td>Lectures – tutorials – examinations – presentations – seminars</td>
</tr>
<tr>
<td>Computing Lab 314</td>
<td>3</td>
<td>10</td>
<td>Computing – lectures – tutorials</td>
</tr>
<tr>
<td>Teaching Room 315</td>
<td>3</td>
<td>56</td>
<td>Lectures – tutorials – presentations</td>
</tr>
<tr>
<td>Computing Lab 317</td>
<td>3</td>
<td>36</td>
<td>Computing – lectures – tutorials</td>
</tr>
<tr>
<td>Library 402</td>
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<td>Study area</td>
</tr>
<tr>
<td>Common Room 414</td>
<td>4</td>
<td>N/A</td>
<td>Staff and PhD Students only</td>
</tr>
<tr>
<td>Meeting Room 444</td>
<td>4</td>
<td>10</td>
<td>Meetings – PhD Examinations – presentations</td>
</tr>
<tr>
<td>Teaching Room 427</td>
<td>4</td>
<td>20</td>
<td>Lectures – tutorials – presentations – seminars</td>
</tr>
<tr>
<td>Laboratory Room 509</td>
<td>5</td>
<td>N/A</td>
<td>Environmental Laboratory (Roger Perry)</td>
</tr>
<tr>
<td>---------------------</td>
<td>---</td>
<td>-----</td>
<td>----------------------------------------</td>
</tr>
<tr>
<td>Laboratory Room 528</td>
<td>5</td>
<td>N/A</td>
<td>Geotechnics Laboratory</td>
</tr>
<tr>
<td>Teaching Room 601</td>
<td>6</td>
<td>40</td>
<td>Lectures – tutorials – meetings – examinations – presentations</td>
</tr>
</tbody>
</table>

**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:

![Link](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:

![Email](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.

![Link](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:

![Link](https://skempton.wufoo.eu/forms/msc-locker-application-201617/)

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/

**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

**Room bookings**

Room bookings on weekdays during term-time may be requested via Wufoo, 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/room-bookings/

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.

**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

**Maps**

Campus maps and travel directions are available at:

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
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 or Postgraduate Tutor. 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:

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)

**Structural Engineering**

00 44 (0) 207 594 6040 (Ruth Bello)

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:


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:

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**
The Department’s postgraduate tutor can offer pastoral support and advice. You can arrange to have a meeting with her at any time during your studies – what you discuss will be completely confidential.

If necessary they will direct you to an appropriate source of support.

The Postgraduate Tutor for your Department is

- Dr Catherine O’Sullivan
- [cath.osullivan@imperial.ac.uk](mailto:cath.osullivan@imperial.ac.uk)

**College tutors**
College tutors operate outside of any department. They provide guidance and assistance to students in regard to welfare issues and are also involved in College disciplinary matters involving students. For more information see:

[www.imperial.ac.uk/student-space/here-for-you/college-tutors-and-departmental-support](http://www.imperial.ac.uk/student-space/here-for-you/college-tutors-and-departmental-support)

**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.

www.imperial.ac.uk/students/fees-and-funding/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.
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)
- Admissions
- International student enquiries
- Research degrees
- Student financial support
- Student records
- Tuition fees

Level 3, Sherfield Building, South Kensington Campus
020 7594 9444
student.hub@imperial.ac.uk
www.imperial.ac.uk/student-hub

Health services

NHS Health Centre and finding a doctor

Even if you're 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.

📍 Room 566, Level 5, Sherfield Building, South Kensington Campus
📞 020 7594 9755
✉️ disabilities@imperial.ac.uk
🌐 www.imperial.ac.uk/disability-advisory-service

**Departmental Disability Officers**

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/support/ddos

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

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

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:

Eugenia Kidd (Civil Engineering Librarian)

e.kidd@imperial.ac.uk

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.

Institution of Civil Engineers Library

1 Great George Street, London, SW1P 3AA

020 7665 2251

library@ice.org.uk

https://www.ice.org.uk/disciplines-and-resources/ice-library-and-digital-resources
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](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](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](www.imperial.ac.uk/study/international-students)
12. Student Records and Data

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
13. Work-life balance

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: Jayneil Master
  jayneil.master13@imperial.ac.uk
- Secretary: Max Castello
  max.castello15@imperial.ac.uk
- Events Officer: Marthe Boulleau
  marthe.boulleau14@imperial.ac.uk
- Industrial Liaison Officer: Hippolyte Mounier-Vehier
  hippolyte.mounier-vehier15@imperial.ac.uk
- Departmental Representative: Christina Barbas
  christina.barbas13@imperial.ac.uk
- International Tour Officer: Susie McAllister
  susie.mcallister14@imperial.ac.uk
- Treasurer: Naveeth Basheer
  naveeth.basheer13@imperial.ac.uk
- Marketing and Web Officer: Xing “Sam” Huang
  xing.huang15@imperial.ac.uk
- Alumni, and Mums & Dads Officer: Maria Stasi
  maria.stasi13@imperial.ac.uk
Imperial College Union

The Union’s range of 340+ 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

Beginners and semi-professionals alike will receive a warm welcome in our sports clubs, which are subsidised by Imperial College Union to make it a little bit cheaper to keep doing a sport you love.

Access to swimming facilities, including sauna, steam room and spa at Ethos sports centre, is completely free from your very first day. Gym facilities across all campuses are also free after you’ve completed a fitness orientation for a one-off charge (£40 in 2016–17).

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:

🔗 [www.imperialcollegeunion.org/you-said-we-did](http://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:

🔗 [www.imperial.ac.uk/students/academic-support/student-surveys/pg-student-surveys](http://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:

✉️ [surveys.registrysupport@imperial.ac.uk](mailto:surveys.registrysupport@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, CPD, or CDT 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/
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.
- Attendance at compulsory timetabled plagiarism and referencing sessions.

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-BA 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.
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.

Special examinations arrangements:

Disability Advisory Service

The Disability Advisory Service works with individual students no matter what their disability to ensure that they have the support they need. They can also help if you think that you may have an unrecognised study problem such as dyslexia. Our service is both confidential (information about you is only passed on to other people in the university with your agreement) and individual in that any support is tailored to what you need.

Some of the sorts of things we can help with are:
• Being an advocate on your behalf with others in the College such as your departmental liaison officer, senior tutor or exams officer, the accommodation office or the estates department.
• Checking that your evidence of disability is appropriate and up-to-date.
• Arranging a diagnostic assessment for specific learning difficulties.
• Help with applying to the College for the cost of an assessment.
• Help with your application for the Disabled Students Allowance (DSA), see below.
• Helping students not eligible for the Disabled Students Allowance in obtaining support from other sources.
• Help with arranging extra Library support.
• Supporting applications for continuing accommodation for your second or later years.

http://www3.imperial.ac.uk/disabilityadvisoryservice

**Disabled Students Allowance**

The Disabled Students' Allowance (DSA):

• Is a grant, not a loan and does not have to be paid back.
• Does not depend on a student's income or the income of their parents, guardians or carers.
• Does not affect entitlement to other benefits.
• Is available to both undergraduates and postgraduates who are UK residents and pay home fees.
• Helps disabled people to study in higher education on an equal basis with other students.

http://www.imperial.ac.uk/disability-advisory-service/support/dsa/
Motivation and revision

Approach-avoidance

When anticipating an important but stressful event we are bound to have feelings of ambivalence – an "approach avoidance dilemma." With revision and exams, the "approach" side is driven by expectations of reward – e.g. a concrete achievement; "avoidance" is mainly due to anxiety and negativity. Instead of allowing unhelpful thoughts and feelings to fester inside you, become more aware of what exactly is holding you back and filling you with pessimism or dread.

So put your concerns about revision and exams into words. Jot them down on a piece of paper as they arise, in any order, as one would in a brainstorming exercise. Naming these inner "devils" and externalising them gives us some psychological space and vantage point from which to understand and confront them. If you find it difficult to generate enough items, keep a journal in which to record thoughts and feelings associated with studying and exams. This can help identify the fears, excuses, competing needs and habits diverting you from the work. Some of these stereotypes of procrastinators may reveal your hidden feelings or belief-system about exams or about yourself:

1. Self-indulgent
   - Denial of responsibility / or overconfident.
   - Not lazy, but has low frustration tolerance.
   - Escapist tendencies.
   - Requires stimulus to raise anxiety (e.g. approaching deadline).

2. Tense and fearful
   - Denial of potency – de-skilling self unnecessarily.
   - Self-critical, low self-esteem.
   - Overwhelmed by the importance of the exam, pressure to succeed.
   - Needs to develop anxiety-reducing and esteem-enhancing strategies.

3. Perfectionist
   - 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.
   - Needs to develop more realistic appraisals of self and demands of task.

Some students habitually get stuck in one of these patterns. However it may be more helpful to consider them as phases we can all go through.

Self-monitoring and self-talk

Self-monitoring can help you regain a more objective outlook. Devise self-talk that challenges the inherent flaws in perfectionist logic, typically dominated by "polarisation" and "emotional reasoning" distortions. Be very suspicious of internal "should," "musts" and "oughts" which make you think the way you feel. Imagine yourself as capable of making choices, rather than having to give in to obsessions. Break down the task into more manageable stages. For instance, cover essentials first, add refinements or further details later, if there is time. Give yourself permission to make mistakes - aim for "good-enough" efforts, to counter "all or nothing" tendencies. In other words, learn to be more selective in your work and less harsh on yourself generally.

Revision tips:

- Watch out for "should", "must" and "need to" demands that you place on yourself. Imagine yourself as capable of making choices, rather than having to give in to obsessions. For example, replace “I MUST learn all the material” with “It would be nice to learn all the material” – this way,
you will experience less anxiety and stress if you are not always able to meet your (unrealistically) high expectations.

- Break a large task into manageable parts! For example, cover the essentials first, add refinements or further details later -- if there is time.
- Give yourself permission to make some mistakes! Aim for "good enough" efforts to counter "all or nothing" thinking tendencies (e.g. "if don’t get an A, I’m a failure"). Practice being more selective in your work and less harsh on yourself!

**Study and exam skills**

**Organising study**

The first task in organising yourself is to sort out topics for revision, as it is usually unrealistic to cover everything. Your selection of topics needs to be based on the syllabus and examination requirements, on predictions derived from past papers, and on guidelines suggested by tutors or indicated by course work covered.

Then devise a routine of study periods which is realistic and productive, with suitable rest intervals and proper attention to diet, sleep and recreation (especially if you’re a workaholic!) Break down targets into manageable units. Ticking off completed units creates a sense of forward movement. A checklist for the day's targets, provided these are achievable goals, can similarly boost morale.

Make these plans and checklists rough guides only, as time spent studying cannot be equally productive. Deal with less demanding tasks in periods of the day when you are less alert and focused. If you find yourself struggling unproductively with a problem - take a break, switch to some other work, or discuss the problem with friends and tutors (if possible).

**Learning strategies**

You may improve your learning effectiveness by reading about study skills. Select and adapt suggestions to suit your own learning style and circumstances. Major alterations to your approach, especially nearer the exams, are unlikely to be productive. However, the following points are worth considering:

- 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.
- A useful general strategy is the **PQRST** – i.e. first skim through the material, particularly the contents, charts, headings, summaries and parts of the text to obtain a **Preview**. Formulate **Questions** (from titles, headings or sentences) that highlight what you aim to derive from the text, to guide your reading. **Read** actively by selecting material and making appropriate notes of key steps or ideas. **Summarise** the main points using paraphrases, lists, key words, patterns and flow diagrams, connecting them with knowledge from other sources. **Test** yourself by reciting and reviewing the summaries immediately after learning the material, then at later intervals. Adapt this approach accordingly when learning key examples in problem sheets involving calculations and procedures.
- Keywords, patterns and flow diagrams linking ideas are useful not only for making master summaries for revision purposes, but also for jotting down ideas and planning answers during the examination (see Buzan's "Use Your Head").
- Index-sized cue cards, easy to carry around for frequent revision (e.g. when travelling), are useful for recording information that you find particularly hard to remember. On them can be displayed facts, figures, formulae - using colours, keywords, mnemonics and other memory aids. Sometimes displaying such information on wall charts around the room can also help.
- For more efficient study "spaced" learning is generally preferable to "massed" learning, as it has more time to sink in. Revise related topics together and take regular short breaks after two-three hour blocks at suitable "achievement" points.
- Practise answering past exam questions on a topic (even if only in skeletal form) and make up
some of your own that bring together typical "angles" or expose features that have not yet appeared in past papers. It is invaluable at this stage to compare notes with other students and to obtain feedback or clarification from tutors.

- Try at least one question under exam conditions – but only after having learned the topic or previously attempted the question. The aim, as in mock exams, is primarily to help reduce stress and pacing problems later, not to undermine confidence.

**Exam skills**

- Read the exam paper carefully, underlining key words and instructions. Don't panic. Many students will feel unable to answer any of the questions at this stage, due to the surge of anxiety.
- Note how many questions you are required to answer; if any are compulsory or need to come out of specific sections - the format may have changed from previous years.
- Tick the questions you intend to answer. Make a rough timetable, allocating equal time to equally-weighted questions, allowing perhaps about 15 minutes "planning" and 10 minutes "finishing off" times, overall, for a typical 3-hour paper.
- Answer questions in the order: easiest, favourite, and difficult, to avoid getting demoralised. Attempt all the questions required, as usually the first 50% of marks for any question are easier to obtain than the next 50%.
- Analyse carefully the precise wording of questions you intend to answer – it is easy otherwise to end up answering a question that was not asked.
- Don't rely on your memory more than you have to – jot down key ideas that emerge about any of the questions, and use them when "planning" an answer. This might show the examiner what you had in mind, if you run out of time.
- The last 5-10 minutes are, ideally, for putting finishing touches – crossing out unwanted script, ensuring that questions are clearly numbered and that all answer books display your identification number.

**Emotional preparation**

**Practical preparations** – check the time and venue of the exam and work out how to get there in good time. Make sure you have the necessary equipment ready (watch, pens, etc.)

**Emotional preparations** – mentally rehearse how you will tackle the exam as a whole, and how you will deal with anxiety, following suggestions described below. Consider what might additionally help – e.g. staying away from crowds gathering outside the exam hall, until the last moment, arranging to have a friend distract you with mundane talk or accompany you on the journey. If it helps sitting at a desk in a particular position in the hall (e.g. front or back) make arrangements with College authorities well in advance of the exam.

**Memory considerations** – the night or morning before the exam review your revision notes and cue-cards systematically, rather than attempt to learn complex new material. If appropriate, capitalise on short-term memory by glancing at your "difficult" cue cards, just before entering the exam hall, and reproducing them, when you're allowed to start (before reading the questions - to safeguard the memory trace).

If you should get a mental block:

- Give yourself about four minutes to remember or puzzle out the answer. Failing that, move on to the next question. If in the meantime ideas for dealing with the problem question emerge, jot them down before you forget them.
- With mathematical questions, it pays to stick with the problem a bit longer, say ten minutes. Sometimes it helps to think back to first principles; or to represent the problem diagrammatically or more concretely, or even to think laterally about related issues.
- Remember to adjust your timetable accordingly, and to still attempt all the required questions.

After the exam – don’t indulge in post-mortems and comparisons with others. Review what went well in your overall approach, before and during the exam including the way you handled anxiety. Aim to improve upon that in the next exam.

Anxiety and panic

Self-management

During revision and exams, anxiety is a common student problem. Up to a point anxiety can help us engage and stay focused on the task. But when overanxious avoidance tendencies intensify, we procrastinate. In an exam, over-anxiety makes our thinking more rigid and confused, so we don’t do ourselves justice.

The way to handle this anxiety and stress is through more empowering self-management:

Cognitively – by facing your fears with more constructive self-talk.

Behaviourally – by devising and sticking to an effective study programme, in which you also take care of your recreational and physical needs.

Emotionally – by containing your fears through more insight and foresight: using appropriate self-monitoring, distraction and relaxation strategies, and in some cases medication.

These are admittedly difficult but manageable adjustments to make, particularly if taken gradually, a step at a time. If you’ve had severe anxiety in past exams do seek help and advice in good time. Your GP could prescribe beta-blockers, for instance, which take away the physical symptoms of anxiety and help you feel more “in control.” Come also to the Exam Stress Workshops held at the Health Centre twice a year.

“Stop the Wasp”

If you start panicking in the exam, finding that the harder you try the worse you feel, try taking the following steps:

STOP – the self-defeating thoughts that are buzzing around like wasps – tell yourself instead that you are going to survive this experience, no matter what happens. Go through the following “W-A-S-P” squashing procedure, which you’ll need to practise during milder forms of anxiety in the revision period (and so learn to recognize 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 more constructive perspective.

ABSORB – taking in the relaxation, flood your mind with constructive self-talk (ideally from a repertoire of previously prepared and practiced phrases) then slowly open your eyes and calmly bring yourself to face the exam situation.

SLOWLY PROCEED – get going again with the paper, as best you can, calmly, a step at a time.

Note:
- 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 technique that works for you (e.g. the isometric exercise described below).
• If your breathing pattern has been rapid and shallow, you may need to avoid hyperventilating, by pausing after long exhalations, and breathing with stomach, rather than upper chest, movements. If the hyperventilating continues, 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.

Relaxation and meditation

Relaxation strategies

Each of the following approaches has its own value and applications. The more mental techniques are probably better at reducing general levels of stress over time, the physical ones are more effective when anxiety is acute and the mind is confused. Basically, you'll need to experiment and then practise your favourite techniques well before the exam – taking advantage of mini crises during the revision period.

Meditation

There are various kinds of meditation techniques around. These generally induce an altered state, which is normally relaxing and beneficial. However, anyone with a mental illness, prone to reality confusion, depersonalisation etc. should seek medical advice before trying out such techniques.

Transcendental Meditation has been the most thoroughly researched, especially for its relief of stress and other health benefits. TM is a subtle, effortless technique and requires no involvement with the organization, or changes in lifestyle or beliefs. However, it is expensive to learn and, as with other practices, not everyone seems to benefit. For current student rates and information pack ring 020 7402 3451.

Benson's "Relaxation Response", a more mechanical technique, also achieves good relaxation results:
• Once or preferably twice a day, sit comfortably with eyes closed, for 15–20 minutes.
• Become aware of your breathing. Breathe easily and naturally, and with every exhale mentally repeat your mantra – a sound or word like "relax", "one" or "om."
• Maintain a passive, accepting attitude – e.g. have no goals or expectations, other than comfortably following the procedure. Don’t try to resist other thoughts or strain to think your mantra clearly.
• When aware of having been distracted by other thoughts, simply switch your attention back to the mantra.

Variants
• If you want a Christian mantra, you can use the Aramaic "ma-ra-na-tha", as suggested by John Main (ring 020 7937 4679 for the Kensington Christian Meditation Centre).
• You may prefer to just follow the naturally changing rhythms of the mantra and ignore the breathing (but stick to one method).
• Or you can follow the breath without a mantra – Mindfulness of Breathing, which can be learned at local Buddhist Centres, again simply as a relaxation technique. Ring 020 7727 9382 for further information.

Imagery
• Sit comfortably with eyes closed.
• Notice bodily sensations, and let go any tension. As you breathe out, imagine tension flowing out through your hands and feet. Enjoy a sensation of warmth and heaviness or lightness, going through the body in waves of relaxation.
• Imagine the body filling up with a healing white, blue or golden light.
• Let the light radiate around you and transport you to a real or imaginary place – your ideal relaxation sanctuary.
• Vividly imagine actually being there, absorbing it with all your senses.
• Feel the sense of absolute peacefulness and calm, for some minutes. Then gradually bring yourself back to your present situation, with a lingering sense of calmness and inner radiance.
• Do this once a day in a leisurely way; and touch base with your sanctuary at odd moments, for a boost.

Muscular relaxation

For those unable to distinguish sufficiently between tension and relaxation, a useful approach is to exaggerate and feel the tension for a slow count of five, then letting go and enjoying the sense of release and relaxation for a minute or so, systematically, through different muscle groups (as described in the Relax and Enjoy It tape listed below). The following sequence can be remembered using the phrase "All New Exercises Must Take Longer": All (Arms and hands) New (neck and shoulders) Exercises (eyebrows, eyelids and forehead) Must (mouth, lips, tongue and throat) Take (trunk - chest, abdomen, hips) Longer (legs).

Tension is produced by clenching fists; bending or extending arms; pushing head against support; shrugging shoulders; raising eyebrows. Frowning; tightly closing eyes; biting teeth together; pressing tongue against mouth; pressing lips tightly; holding a deep breath; flattening in the stomach; squeezing buttocks together; stretching legs and toes.

After a little practice you should find it possible to relax without any prior tensing, simply by focusing on the same muscle sequence and allowing each to unwind and relax. This quick and easy relaxation skill can then be used whenever needed, in daily life.

Note – with tensing techniques, stay much longer relaxing than tensing.

A helpful Isometric Exercise, along similar lines, can be used when sitting at a desk during revision or exams:
• Pull in stomach muscles tightly, hold for a count of five, release and relax.
• Clench fists tightly, hold, relax.
• Extend fingers, hold, relax.
• Grasp below seat of chair, pull up and hold, relax.
• Press elbows tightly into side of body. Hold, relax. Push foot hard into floor, hold, relax. Relax briefly with dangling arms, or resting head in arms on desk.

Exercise

Some people just can't relax easily, but can feel more "in control" through activity and exercise. Vigorous exercise can burn off tension, and counterbalances the passivity of studying and relaxation. Walking through a park or doing simple yoga postures are milder but also effective alternatives.

Sleeping Problems

Sleeping problems sometimes emerge as exams approach. Partly this is due to late nights studying and to what we eat and drink, so it's advisable to take preventative action, where possible. Gradually establish sleeping patterns that can be maintained more or less unchanged even during exams. Avoid late afternoon naps, as they use up REM (dreaming) sleep needs – try relaxation or meditation instead. Eliminate or reduce alcohol and caffeine consumption. Mild exercise or a relaxing bath at
bedtime helps. Basically, allow yourself a “winding down” period before bed, to stop yourself thinking and worrying. If still struggling to sleep after about 20 minutes, avoid reinforcing negative associations – get out of bed for about 10 minutes, do something undemanding, then try again. Sometimes sleeping in a different place, or even at the other end of the bed, can help. An audio tape some students have found helpful, “Sleep Well”, is listed below.

**Mental rehearsal**

Having achieved some degree of relaxation using one of the above techniques, it is useful then to imagine oneself “doing” the dreaded thing, in this case the exam, visualising oneself emotionally “coping”. With eyes closed, run through the whole exam situation, watching it unravel as if on a screen, noting things to look out for (e.g. time budgeting, if you know that’s a problem); mentally step into the screen, with a sense of calm and composure; take in the scene with different sensory organs, all the while imagining coping with the exam and with surges of anxiety (e.g. using self-talk or “stop the wasp” etc.). This can be a fairly brief mental exercise.

Mentally rehearsing the exam scenario clarifies the task in terms of steps, desensitises fear through imaginary exposure and helps one face the real event with a greater sense of internal resources. It is useful therefore to learn to employ mental rehearsal routinely as part of a relaxation exercise. It can also be used to visualise oneself coping differently, more positively, in other problematic situations e.g. to counter negativity during revision.

**Resources**

**Audio Aids**

The audio aids mentioned above, Relax and Enjoy It and Sleep Well, produced by clinical psychologist Dr R. Sharpe, are obtainable from: [www.aleph1.co.uk](http://www.aleph1.co.uk) at £10.00.

**Books**

Other useful resources (available from certain bookstores and Amazon online) include:

- *The Sciences Good Study Guide*: Northedge, J. Thomas, and A. Peasgood
- *The Arts Good Study Guide*: E. Chambers, and A. Northedge
- *Use Your Head*: Tony Buzan
- *The Mind Map Book*: Tony and Barry Burzan
- *The Complete Book of Relaxation Techniques*: Jenny Sutcliffe

**Workshops**

Exam performance workshops are available for Imperial College students, and take place at Imperial College Health Centre during term time. Please see the Health Centre website for further details: [www.imperialcollegehealthcentre.co.uk](http://www.imperialcollegehealthcentre.co.uk) or telephone the Health Centre on 020 7584 6301.

**Acknowledgements**

Dr Robert Sharpe’s audio tapes Pass That Exam and Study Effectively, and his book Self-Help for your Anxiety (Souvenir Press 1991) provide many of the points and ideas found in relevant sections above.

Clayton E. Tucker-Ladd’s online book Psychological Self Help, particularly the chapter on procrastination, is a source of ideas for the section on Motivation and Revision.
Appendix D: Cheating Offences: Policy and Procedures

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. It 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 Advanced Structural Engineering Cluster
Department of Civil and Environmental Engineering

Surname ___________   First Name ___________   CID ___________
Module ___________________________________________________________
Assignment_________________________________________________________
Supervisor _________________________________________________________
Submission Date ____________________________________________________

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
Grade awarded: __________________________
Late penalty applied: _____________________
Group Coursework and Project Cover Sheet
MSc in Advanced Structural Engineering Cluster
Department of Civil and Environmental Engineering

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:_________

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: Health and Safety

Student Health & Safety Handbook
Department of Civil & Environmental Engineering
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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 belongings.
- **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>Room</th>
<th>Name</th>
<th>Tel.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Head of Department</td>
<td>442</td>
<td>Prof N. Buenfeld</td>
<td>45955</td>
</tr>
<tr>
<td>Department Safety Officer</td>
<td>413</td>
<td>Dr G. D. Fowler</td>
<td>45973</td>
</tr>
<tr>
<td>Technical Services Manager</td>
<td>308A</td>
<td>Mr A. C. Hargreaves</td>
<td>45993</td>
</tr>
<tr>
<td>Department Operations Manager</td>
<td>440A</td>
<td>Mrs L. A. Cumming</td>
<td>42715</td>
</tr>
<tr>
<td>Assistant to the Technical Services Manager</td>
<td>437</td>
<td>Mr S. Hullock</td>
<td>45869</td>
</tr>
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**Departmental Health and Safety Committee:**

<table>
<thead>
<tr>
<th>Role</th>
<th>Room</th>
<th>Name</th>
<th>Tel.</th>
</tr>
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<tbody>
<tr>
<td>Chairman of Department Safety Committee</td>
<td>308A</td>
<td>Mr A. C. Hargreaves</td>
<td>45993</td>
</tr>
<tr>
<td>DSE, COSHH, Radiation, Fieldwork &amp; Biological Safety Advisor</td>
<td>413</td>
<td>Dr G. D. Fowler</td>
<td>45973</td>
</tr>
<tr>
<td>Laser Safety</td>
<td></td>
<td>Vacant</td>
<td></td>
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<tr>
<td>Manual Handling Assessor</td>
<td>236</td>
<td>Mr T. Stickland</td>
<td>43224</td>
</tr>
<tr>
<td>Committee Secretary</td>
<td>437</td>
<td>Mr S. Hullock</td>
<td>45869</td>
</tr>
<tr>
<td>First Aid Coordinator</td>
<td>507</td>
<td>Mrs C. A. Edwards</td>
<td>45970</td>
</tr>
<tr>
<td>EWRE Section Academic Safety Representative</td>
<td>303</td>
<td>Prof C. R. Cheeseman</td>
<td>45971</td>
</tr>
<tr>
<td>Fluid Mechanics Section Academic Safety Representative</td>
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<td>Vacant</td>
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<tr>
<td>Soil Mechanics Section Academic Safety Representative</td>
<td>531</td>
<td>Dr J. R. Standing</td>
<td>46072</td>
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<tr>
<td>Structures Section Academic Safety Representative</td>
<td>228B</td>
<td>Dr H. S. Wong</td>
<td>45956</td>
</tr>
<tr>
<td>Transport Section Academic Safety Representative</td>
<td>337</td>
<td>Dr P. Angeloudis</td>
<td>45986</td>
</tr>
<tr>
<td>UG Student representative</td>
<td></td>
<td>UG DEPT REP</td>
<td></td>
</tr>
<tr>
<td>PG Student representative</td>
<td></td>
<td>Vacant</td>
<td></td>
</tr>
<tr>
<td>Skempton Building Manager (Office in City &amp; Guilds Building)</td>
<td>567C</td>
<td>Mr G. Fairhurst</td>
<td>49639</td>
</tr>
<tr>
<td>Faculty of Engineering Safety Manager (Office in Faculty Building L2)</td>
<td>567C</td>
<td>Mr S Greenwood</td>
<td>40821</td>
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**Imperial College Safety Department (level 4 Sherfield Building):**

<table>
<thead>
<tr>
<th>Role</th>
<th>Name</th>
<th>Tel.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Director of Safety Department</td>
<td>Dr S. Johal</td>
<td>49420</td>
</tr>
<tr>
<td>Deputy Director of Safety Department</td>
<td>Dr A. M de Paiva</td>
<td>49421</td>
</tr>
<tr>
<td>Safety Department Administrator</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: g.fowler@imperial.ac.uk
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>Ben Collinson*</td>
<td>332</td>
<td>49896</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 Tom Shire*</td>
<td>417</td>
<td>46004</td>
</tr>
<tr>
<td>Carol Edwards*</td>
<td>507</td>
<td>45970</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

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

<table>
<thead>
<tr>
<th><strong>Evacuation procedure:</strong></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><strong>Campus emergency number</strong></td>
<td>4444 (from an internal telephone) 020 7589 1000 (from all other telephones).</td>
</tr>
<tr>
<td><strong>Frequency of fire drills</strong></td>
<td>Annual (usually during the first 4 weeks of the autumn term)</td>
</tr>
<tr>
<td><strong>Frequency of alarm testing</strong></td>
<td>Weekly at around 8am on Tuesday mornings</td>
</tr>
<tr>
<td><strong>Locations of:</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Fire alarm call points</strong></td>
<td>Five per floor located between each set of fire doors</td>
</tr>
<tr>
<td><strong>Emergency exits</strong></td>
<td>See map in this book</td>
</tr>
<tr>
<td><strong>Evacuation routes</strong></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><strong>Assembly point</strong></td>
<td>On the steps of the Queen’s Tower</td>
</tr>
<tr>
<td><strong>Fire extinguishers etc</strong></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><strong>Safety Notice Board</strong></td>
<td>Located on Level 4 on the wall outside the room 415</td>
</tr>
<tr>
<td><strong>Departmental Safety staff</strong></td>
<td>See the list enclosed in this book and in the lifts</td>
</tr>
<tr>
<td><strong>First Aid Arrangements</strong></td>
<td>See the list enclosed in this book and in the lifts</td>
</tr>
<tr>
<td><strong>Accident reporting</strong></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><strong>Safety Department</strong></td>
<td>Provides advice on Safety issues. Located in Sherfield Building, L4.</td>
</tr>
<tr>
<td><strong>Occupational Health</strong></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><strong>Security</strong></td>
<td>Provides a 24 hour, college-wide service relating to building security, first aid and emergency support.</td>
</tr>
<tr>
<td><strong>Web site information</strong></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><strong>Key Web site addresses</strong></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><strong>Building Access Hours</strong></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><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>--------------------------</td>
<td>--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</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 you are not put at risk during your time 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 Department Safety Committee, which meets every term. The committee comprises representatives from all the Sections in the Department, Student representatives, 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://www3.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, from initial safety registration, laboratory registration through risk assessment creation and final approval. 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. 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:

Normal opening hours: 8am – 6pm Monday to Friday

Swipe card access only: 7am – 8am & 7pm – 12pm, Weekdays
7am- 12pm Weekends and Public Holidays

College “Closed” (swipe inactive): 12pm to 7am every day and during selected days during College Closure at Christmas and Easter

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 yourself 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 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 403, dedicated to printer and toner cartridges.

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**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.**

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**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**

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The Department’s assembly point is around the base of the Queen’s Tower

△ = Emergency exit
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.

There will be a fire drill during the first term, to familiarise you with emergency procedures.

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://www3.imperial.ac.uk/safety
Emergency

For all Emergencies dial 4444

Direction of the nearest escape route

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
Typical accidents in the Department tend to occur due to “slips, trips, falls” and poor lifting practise. 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 sticker indicating that it may be
used in the department (see image). Any equipment not displaying this sticker or meeting the criteria below, 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 Departments “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).

http://www3.imperial.ac.uk/estatesfacilities/reportrequest/onlineforms/waste/weee

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 office 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.

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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 (or safety) shoes

**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
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.

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 an 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 cover 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 approved 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 & Commonwealth Office web pages contain all the information to help make your trips as safe and enjoyable as possible: http://www.fco.gov.uk/. Follow the links for “travel advice”.

The USA Government’s CIA “World Fact Book” also contains a large amount of details on every country recognised by the USA Government: http://www.cia.gov/cia/publications/factbook/

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.

Hard Hat

The Department will provide Hard Hats for all undergraduate students in the Department. The Hats will be needed for most field courses and should be looked after. Please be aware that British Standard Hard Hats must be thrown away after 4 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.

Safety Glasses

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. These are issued as part of the safety pack to the undergraduate students. MSc students will be issued with safety glasses as required for laboratory and field courses.

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. We will provide all undergraduate students (as part of their safety pack with a pair of cotton site gloves suitable for site use which you will need for all your site visits. Disposable gloves of a suitable type will be provided for laboratory-based 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.

Safety Boots

All undergraduates and some MSc students (Check your course information) must own a pair of Safety boots with steel toe caps. 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 1st and 2nd 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). Additionally, safety boots can be readily purchased from many high-street suppliers, but these must meet a minimum requirement of offering steel top caps, mid-sole protection against penetration by sharp objects and ankle support.

All first year undergraduate (MEng) students will be issued with a safety pack prior to the commencement of fieldtrips. This equipment must 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.

MEng students must buy their own safety boots.

MSc students will be issued with 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/OCCHEALTH/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 &
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 & 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 & 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 & 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 & 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 & 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 & 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 & 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
September 2016
Appendix 1: A quick guide to using the Department SharePoint Safety Site

A Short Guide to using the SharePoint Health & Safety 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 or Line Managers must approve the assessment and sign it off.
- Secondary Checker also approves (Local Lab Manager or DSO)

The SharePoint Site

- An automated system to 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

Risk Assessment – A Step-by-Step guide

- Log onto SharePoint: https://share.imperial.ac.uk/SitePages/Home.aspx
- Enter your ICT (College) username and password
- The College SharePoint site will open

Use Explorer v10, Firefox or Chrome. It does not work in Linux or Explorer v11

Imperial College SharePoint Site

- Select “Faculty of Engineering” from the menu bar

Faculty SharePoint Site

- Select “Civil (& Environmental) Engineering”
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

Using the Site

1. **1st step: Complete a General Risk assessment:**
   - This covers many activities, but occasionally you will need to use special forms for certain tasks (COSHH, Radiography, Biologicals, etc.)
   - You need to identify all the risks and quantify them
   - Attach extra information including Engineered procedural designs, SOPs, etc.

2. **2nd Step: submit your form(s) for approval:**
   - Approvers may include: Your Supervisor, the Laboratory Manager, A qualified 2nd engineering academic (for Structures) and the DSO.

3. **3rd Step: Forms are assessed and approved (or rejected) by your Supervisor & Lab Manager

**SharePoint General Risk Assessment form**

**Describe the Hazards & quantify the risk before & after control measures are identified**

- Share risk
- Probability & severity
- Risk assessment
- Control measures
- Hazard identification
- Evaluation of control measures
- Risk reduction
- Hazard management
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, plumes, gases, solvents, foams, 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, FW2)

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

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
Tel. 45973
Appendix G: Map of South Kensington Campus
Building key:

1. Beit Quadrenary
Beit Hall, Chaplaincy, Imperial College Union
2. Imperial College Union
3. Ethics Sports Centre
Sport Imperial
4. Prince’s Garden, North Side
No.6: Early Years Education Centre
No.10-12: Garden Hall
No.15: Centre for Environmental Policy
5. Weeks Hall
6. Blackett Laboratory
Physics, Institute of Shock Physics
7. Nelder Hill Building
Aeronautics, Biology, Centre for Process Systems Engineering, Chemical Engineering, Composites Centre
8. Bence 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. Goldsmiths Building
Bioengineering, Materials
13. Huxley Building
Computing, Institute of Shock Physics, Mathematics, Physics
14. ACE Extensions
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. Prince’s Gate
Business School
19. Eastside
Gibbon Hall, Lansdown Hall, Wilkinson Hall, Eastside bar and restaurant, Essentials convenience store
20. Sherfield Building
Level 1: Catering, Centre for Health Policy, Queen’s Towor Rooms, Security Reception
Level 2: Bank (Santander), 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 Schools, HR Pensions, Human Resources, International Office, Outreach, Centre for Continuing Professional Development, Registry, Sport Imperial, Student Accommodation Centre, Student Hub
Level 4: Archives, Continuing Professional Development Unit, ICT, ICT Helpdesk, Occupational Health Service, Safety Department
Level 5: Birth Music and Arts Centre, Careers Service, Communications and Public Affairs, Development, Educational Development Unit, Estates (Projects, Facilities, Finance, Property Management) Read and Poplar 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, Faculties of Engineering, 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. 5B Prince’s Gate
Ballroom, Billiard Room, Boardroom, College Room, Garden Room, Imperial Consultants, Oak 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 Museum Libraries
Central Library, Library Archives and Special Collections, Science Museum Library
26. Queen’s Tower
27. Skempton Building
Civil and Environmental Engineering, Centre for Environmental Control and Waste Management, Centre for Transport Studies, Wohl Rauch Out Lab
28. Mechanical Engineering Building
ICT, Mechanical Engineering, Vibration University Technology Centre
29. Southside
Falmouth Road, Saltire 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 Biosciences, 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 RCS1
Biochemistry, Biology, Centre for Photomolecular Sciences, Chemistry
35. 59 Prince’s Gate
Imperial Innovations
36. Alumni Visitor Centre
College Cafeteria
1.0 Aims

- To provide a good understanding of a range of topics within the field of concrete technology, including constituent materials and mixture proportioning, properties of concrete in the fresh and hardened state, microstructure, strength, volume changes and durability.
- To understand the key physical and chemical processes influencing the behaviour and performance of concrete in service.

2.0 Syllabus

- Constituent materials used in concrete (cement, supplementary cementitious materials, aggregate, water and admixtures) with emphasis on their influence on the microstructure of concrete.
- Properties and behaviour of concrete including early age properties, mechanical properties, volume changes and durability.
- Typical problems affecting concrete and their prevention strategies.
- Design and selection of mix proportions to produce concrete with specified performance.

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<th>No.</th>
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<tr>
<td>02</td>
<td>Supplementary cementitious materials; Hydration of cement; Microstructure development</td>
<td>HW</td>
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<tr>
<td>03</td>
<td>Admixtures; Aggregates</td>
<td>HW</td>
</tr>
<tr>
<td>04</td>
<td>Properties of fresh concrete; Early age properties</td>
<td>HW</td>
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<tr>
<td>05</td>
<td>Strength and elasticity; Tutorial</td>
<td>HW</td>
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<tr>
<td>06</td>
<td>Swelling, shrinkage and creep; Temperature effects</td>
<td>HW</td>
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<tr>
<td>07</td>
<td>Chloride-induced corrosion; Carbonation-induced corrosion</td>
<td>HW</td>
</tr>
<tr>
<td>08</td>
<td>Freeze-thaw damage; Sulphate attack; Alkali-aggregate reaction</td>
<td>HW</td>
</tr>
<tr>
<td>09</td>
<td>Design and proportioning of concrete mixtures; Lab session</td>
<td>HW</td>
</tr>
<tr>
<td>10</td>
<td>Tutorial; Coursework presentations</td>
<td>HW</td>
</tr>
</tbody>
</table>
3.0 Intended learning outcomes

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

- Understand how the constituents and mix proportion of concrete influence its early age properties, mechanical properties, volume changes and durability, via an appreciation of their influence on concrete microstructure.
- Gain the ability to design and proportion concrete mixtures to a specified performance.
- Become familiar with common problems affecting concrete in construction and their prevention.

4.0 Teaching methods

The module is taught as a series of lectures, group discussions and embedded informal tutorials. Throughout the module, students work in teams on a project closely linked with the taught material. The module ends with a laboratory session to demonstrate the process of concrete production and tests methods for fresh and hardened concrete.

5.0 Assessment

The module will be assessed by a written examination and coursework. The split of the marks will be 80% for the exam and 20% for the coursework. The exam consists of essay and multiple-choice questions. The coursework requires students to work in small groups to produce a technical report and a lecture on a selected topic related to concrete technology. Detailed written and oral feedback will be given to students.

6.0 Recommended textbooks

Category as defined by Central Library:

C = Core, S = Supplementary

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
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</thead>
<tbody>
<tr>
<td>S</td>
<td>Lea’s Chemistry of Cement &amp; Concrete, P.C. Hewlett (Editor), Butterworth-Heinemann, 2003.</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>
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<tr>
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<th>Sustainability</th>
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CI9-STR-02 Reinforced Concrete I

<table>
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<th>Course leader:</th>
<th>Dr Robert Vollum</th>
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<td>Other contributors:</td>
<td></td>
</tr>
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<td>Pre- or co-requisites:</td>
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<td>Term:</td>
<td>Autumn</td>
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<td>Contact hours:</td>
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<td>ECTS units:</td>
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<tr>
<td>FHEQ Level:</td>
<td>7</td>
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<tr>
<td>Assessment:</td>
<td>Coursework, written examination</td>
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</table>

1.0 Aims

- To give students a good understanding of the design and behaviour of reinforced concrete structures at the design ultimate limit state.
- To look at the design of framed building structures in some detail with particular emphasis on design for flexure, shear and torsion.
- To consider the design of shear walls.

2.0 Syllabus

- Design for bending and combined bending and axial force.
- Design for shear.
- Design for torsion and combinations of shear, torsion and bending.
- Design of framed structures and shear walls.
- Detailing of reinforcement.

<table>
<thead>
<tr>
<th>No.</th>
<th>Topic</th>
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<tbody>
<tr>
<td>01</td>
<td>Design for flexure</td>
<td>RV</td>
</tr>
<tr>
<td>02</td>
<td>Design of continuous beams</td>
<td>RV</td>
</tr>
<tr>
<td>03</td>
<td>Span to depth ratios</td>
<td>RV</td>
</tr>
<tr>
<td>04</td>
<td>Design of framed structures</td>
<td>RV</td>
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<tr>
<td>05</td>
<td>Shear</td>
<td>RV</td>
</tr>
<tr>
<td>06</td>
<td>Torsion</td>
<td>RV</td>
</tr>
<tr>
<td>07</td>
<td>Detailing of reinforcement</td>
<td>RV</td>
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<tr>
<td>08</td>
<td>Revision</td>
<td>RV</td>
</tr>
<tr>
<td>09</td>
<td>Design for flexure</td>
<td>RV</td>
</tr>
<tr>
<td>10</td>
<td>Design of continuous beams</td>
<td>RV</td>
</tr>
</tbody>
</table>
3.0 Intended learning outcomes

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

- Understand structural behaviour and the background to the design methods in EC2 and other codes where appropriate.
- Have a good understanding of the design and behaviour of reinforced concrete structures at the ultimate limit state.

4.0 Teaching methods

A combination of lectures, tutorials and progress tests.

5.0 Assessment

There is one piece of design related coursework which draws upon the taught material which is worth 20%.

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).

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

<table>
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<tr>
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<tbody>
<tr>
<td>P</td>
<td>C</td>
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</tbody>
</table>
CI9-STR-03 Prestressed Concrete (CI4-435)

Course leader: Dr Ana Ruiz-Teran

Other contributors:

Module status: Concrete Structures (Core); General Structural Engineering (Elective)

Pre- or co-requisites:

Term: Autumn

Contact hours: 30

ECTS units: 5

FHEQ Level: 7

Assessment: Coursework, written examination

1.0 Aims

- To introduce the fundamental principles about the structural behaviour and design criteria of Prestressed Concrete Structures.
- To introduce the fundamental mechanics to define the internal forces.
- To review the current technology available to prestress concrete structures.
- To introduce the formulae to estimate the initial and time-dependent losses.
- To emphasis the fundamentals but reference is made to Eurocode 2.
- To present the serviceability limit states that are critical for the design of conventional prestressed concrete structures and the inequalities to fulfil such limit states are derived, allowing the prestressing force and its eccentricity to be determined.
- To cover the specific implications for the ultimate limit states.

2.0 Syllabus

- Concept of prestressing (historical approach, and prestressing types).
- Structural analysis of prestressed statically determinate structures including: Anchorage and deviating forces introduced by the tendons; Internal forces and strains due to prestressing; Tendon centroid, and prestressing layouts; Mechanical properties before and after grouting; Introduction of self-weight during prestressing in post-tensioned structures; Introduction of lateral bending during prestressing in post-tensioned structures.
- Structural analysis of prestressed statically indeterminate structures including: methods for the analysis of prestressed statically indeterminate structures: Primary, secondary and total internal forces due to prestressing.
- Prestressing technology including: Steel products and technologies for prestressing (strands, tendons, bars); Anchorage systems, ducts, couplers; Technological requirements for the prestressing layouts; Threading, prestressing, and grouting; External prestressing technology.
- Prestressing losses: Concept of loss and classification of losses (initial and long-term losses); Frictional losses; Elastic shortening losses; Anchorage drawn-in losses and transmission lengths;
Prestressing strategies; Prestressing losses due to concrete creep, concrete shrinkage and steel relaxation.

- Serviceability limit state including: SLS of normal tension stresses (decompression, cracking, and crack opening limit states); SLS of normal compression stresses; SLS deformation, SLS vibration; Prestressing approaches and classes.
- Design of prestressed structures: Central kern; Inequality equations for the design of prestressed concrete structures; Magnel diagrams; Regions where the centroid of the prestressing layout has to be located; Relation between section efficiency and amount of prestressing.
- Specific implications for ultimate limit states.
- Anchorage zones.
- Prestressed concrete slabs.

<table>
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<th>Topic</th>
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<td></td>
<td>Different types of prestressing</td>
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<td></td>
<td>Prestressing by tendons</td>
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<td></td>
<td>Prestressing types according to the moment in which the prestressing</td>
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<td>is applied</td>
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<td></td>
<td>Prestressing types according to the location of the tendons in relation to the concrete section</td>
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<td>Prestressed tie (including examples)</td>
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<tr>
<td>02</td>
<td>Structural analysis of prestressed statically determinate structures</td>
<td>ART</td>
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<tr>
<td></td>
<td>Anchorage and deviating forces introduced by the tendons</td>
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<td></td>
<td>Internal forces due to prestressing in statically determinate structures</td>
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<td></td>
<td>Strains due to prestressing</td>
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<td></td>
<td>Prestressing of in-situ concrete beams (post-tension)</td>
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<td></td>
<td>Tendon centroid</td>
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<td>Prestressing of precast concrete beams (pre-tension).</td>
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<td>Prestressing layouts</td>
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<td>Mechanical properties before and after grouting</td>
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<td>Introduction of self-weight during prestressing in post-tensioned structures</td>
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<td>Introduction of lateral bending during prestressing in post-tensioned structures</td>
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<td>Example</td>
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<td>Structural analysis of prestressed statically indeterminate structures</td>
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<td>Methods for the analysis of prestressed statically indeterminate structures</td>
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<td>Static internal forces due to prestressing; Secondary internal forces due to prestressing and Total internal forces due to prestressing</td>
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<td>04</td>
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<td>Couplers</td>
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<td>SLS of normal tension stresses (decompression, cracking, and crack opening limit states)</td>
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<td></td>
<td>SLS of normal compression stresses</td>
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<td>SLS deformation, SLS vibration</td>
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<td></td>
<td>Prestressing approaches and classes</td>
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<td>Tutorial (Coursework)</td>
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<table>
<thead>
<tr>
<th>08</th>
<th>Design of prestressed structures</th>
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<tr>
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<tr>
<td></td>
<td>Inequality equations for the design of prestressed concrete structures</td>
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<td>Magnel diagrams</td>
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<td>Regions where the centroid of the prestressing layout has to be located</td>
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<td></td>
<td>Relation between section efficiency and amount of prestressing</td>
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<td>Examples</td>
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<td></td>
<td>Ultimate limit states</td>
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<td>Ultimate limit state of normal stresses</td>
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<td>Example</td>
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<tr>
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<td>Ultimate limit state of shear stresses</td>
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<tr>
<th>09</th>
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<tbody>
<tr>
<td></td>
<td>Prestressed concrete slabs</td>
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<td>Course work feedback</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>10</th>
<th>Revision</th>
</tr>
</thead>
</table>
3.0 Intended learning outcomes

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

- Obtain the internal forces due to the prestressing in a prestressed concrete structure, being able to identify the primary and secondary components of the total internal forces.
- Evaluate the initial and time-dependent losses.
- Propose an appropriate system to prestress a particular structure.
- Design the prestressing layout and the prestressing force that fulfils the relevant limit states.

4.0 Teaching methods

A combination of lectures and tutorials.

5.0 Assessment

Assessment will be 75% written examination and 25% coursework (MSc)/100% written examination (UG).

6.0 Recommended textbooks

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

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

- To present the finite element method for structural analysis, to investigate the accuracy and convergence characteristics of various finite elements.
- To consider modelling strategies for improved accuracy and efficiency.
- To encourage the use of finite element software for advanced structural analysis.

2.0 Syllabus

- Introduction to the finite element method.
- One-dimensional element formulation for beams and frames.
- Two-dimensional plane stress/strain formulations.
- Higher-order formulations for plane stress/strain analysis.
- Error estimation and adaptivity in finite element analysis.
- Plate bending elements.
- Application of finite element analysis program ANSYS to structural engineering problems.
3.0 **Intended learning outcomes**

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

- Appreciate the use of hierarchic subdivision processes in tackling complex problems.
- Understand the formulation of typical finite elements for structural analysis and the associated sources of approximation.
- Use finite element analysis software.
- Use computers for simulations.
- Apply techniques of linear algebra.

4.0 **Teaching methods**

Handouts are provided for the various topics, and extensive use is made of the visualiser to elaborate on concepts and application issues. All material, including handouts, visualiser lecture notes and solutions to tutorial problems, are placed on Blackboard Learn for student access. Computer laboratory sessions are also provided making use of screen projection to introduce finite element analysis software.

5.0 **Assessment**

Assessment is by written examination (50%) and the project (50%).

6.0 **Recommended textbooks**

Category as defined by Central Library:

C = Core, S = Supplementary

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<table>
<thead>
<tr>
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<tbody>
<tr>
<td><strong>C</strong></td>
<td>&quot;Finite Element Analysis: Theory and Application with ANSYS&quot;, S. Moaveni, Prentice Hall.</td>
</tr>
<tr>
<td><strong>S</strong></td>
<td>&quot;Concepts and Applications of Finite Element Analysis&quot;, R.D.Cook, Wiley.</td>
</tr>
<tr>
<td><strong>S</strong></td>
<td>&quot;Finite Element Procedures in Engineering Analysis&quot;, K.J.Bathe, Prentice-Hall.</td>
</tr>
</tbody>
</table>
### 7.0 Subject threads

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</table>
### CI9-STR-08 Structural Dynamics

<table>
<thead>
<tr>
<th>Course leader:</th>
<th>Dr Christian Málaga-Chuquitaype (CM)</th>
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<tbody>
<tr>
<td>Other contributors:</td>
<td>Dr Luke Louca (LL)</td>
</tr>
<tr>
<td>Pre- or co-requisites:</td>
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<tr>
<td>Term:</td>
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<td>FHEQ Level:</td>
<td>7</td>
</tr>
<tr>
<td>Assessment:</td>
<td>Written examination</td>
</tr>
</tbody>
</table>

#### 1.0 Aims
- To provide students with a general grounding in the basic concepts and principles of dynamics as applied to structural engineering problems.
- To introduce the students to the most common dynamic phenomena in structural engineering and train them in the application of appropriate modelling approaches, as well as their analytical and numerical solutions.

#### 2.0 Syllabus
- Undamped free vibrations. Damped free vibrations. Response to transient loads: impulse and irregular dynamic loads. Duhamel’s integral. (CM)
- Forced vibration response to harmonic excitation. Dynamic magnification factor and response spectra. (CM)
- Introduction to non-linear dynamics of single-degree-of-freedom systems. Dynamic characteristics of non-linear systems. Friction damping. Simplified approximations and ductility-reduced spectra. (CM)
- Multi-degree-of-freedom models. Formulate equations of motion in both a stiffness and flexibility format and determine natural frequencies. (LL)
- Use orthogonality to uncouple equations of motion to format series of SDOF models using generalised coordinates. (LL)
- Use of response spectra to solve MDOF systems subjected to either pulse loads or a ground motion. (LL)
- Use conservation of energy to formulate pressure impulse diagrams for idealised systems subjected to blast loads. (LL)

<table>
<thead>
<tr>
<th>No.</th>
<th>Topic</th>
<th>Staff</th>
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<tbody>
<tr>
<td>01</td>
<td>Dynamic loads. Time and frequency domains.</td>
<td>CM</td>
</tr>
<tr>
<td>02</td>
<td>Equation of motion and modelling of structural systems.</td>
<td>CM</td>
</tr>
<tr>
<td>03</td>
<td>Free vibration and response to transient loads.</td>
<td>CM</td>
</tr>
<tr>
<td>04</td>
<td>Forced vibration response to harmonic excitation.</td>
<td>CM</td>
</tr>
<tr>
<td>05</td>
<td>Introduction to non-linear dynamics of SDOF.</td>
<td>CM</td>
</tr>
<tr>
<td>06</td>
<td>Introduction and revision of MDOF concepts. Free vibrations of lumped mass beam and frame systems.</td>
<td>LL</td>
</tr>
<tr>
<td>07</td>
<td>Forced vibrations of MDOF systems and modal superposition.</td>
<td>LL</td>
</tr>
<tr>
<td>08</td>
<td>Vibration caused by motion of supports. Earthquake response spectra.</td>
<td>LL</td>
</tr>
<tr>
<td>09</td>
<td>Introduction to blast loads. Modal analysis of pulse loaded structures.</td>
<td>LL</td>
</tr>
<tr>
<td>10</td>
<td>Development and use of Pressure Impulse diagrams for blast loaded problems.</td>
<td>LL</td>
</tr>
</tbody>
</table>

3.0 **Intended learning outcomes**

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

- Analyse and interpret the dynamic response of conventional structural systems and gain insights into their time-dependent nature.
- Formulate appropriate models of simple structural systems under dynamic conditions and apply them to the solution of engineering problems.
- Estimate the natural frequencies and vibration modes of elastic and multiple degree of freedom systems.
- Evaluate maximum values of significant structural response parameters for systems subjected to the most usual forms of dynamic excitation.
- Appreciate the phenomena involved in the loss of linearity in the dynamic response of simple structures as well as the engineering approaches employed to model them understanding their limitations.

4.0 **Teaching methods**

A combination of lectures and tutorials.

5.0 **Assessment**

Assessment will be by a written 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).

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<td>S</td>
<td>C</td>
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</tbody>
</table>
# CI9-STR-09 Reinforced Concrete II

**Course leader:** Dr Robert Vollum

**Other contributors:**

**Module status:**
- Core H2A2 (CS)
- H2U2 (CSBM)
- H2U6 (CSSD)
- H2A1 (GSE)
- Elective H2A3 (EQ)

**Pre-or co-requisites:**
- Spring

**Contact hours:** 30

**ECTS units:** 5

**FHEQ Level:** 7

**Assessment:** Coursework, written examination

## 1.0 Aims

- To give students a detailed understanding of the design of reinforced concrete slabs and structures like deep beams, squat shear walls and pile caps where plane sections do not remain plane.
- To study the serviceability limit states of cracking and deflection in detail.

## 2.0 Syllabus

- The design of membrane panels for plane stress.
- Strut and tie modelling (STM). Applications of STM will include structures like squat shear walls, deep beams and beam-column joints.
- The design of reinforced concrete slabs using elastic and yield line methods.
- Serviceability limit states of cracking and deflection. Issues such as the influence of construction loading on long term deflection and early age thermal cracking will be considered.

<table>
<thead>
<tr>
<th>No.</th>
<th>Topic</th>
<th>Staff</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>Design of membrane panels for plane stress</td>
<td>RV</td>
</tr>
<tr>
<td>02</td>
<td>Design of membrane panels for plane stress</td>
<td>RV</td>
</tr>
<tr>
<td>03</td>
<td>Strut and tie method</td>
<td>RV</td>
</tr>
<tr>
<td>04</td>
<td>Strut and tie method</td>
<td>RV</td>
</tr>
<tr>
<td>05</td>
<td>Yield line design</td>
<td>RV</td>
</tr>
<tr>
<td>06</td>
<td>Yield line design and design of flat slabs</td>
<td>RV</td>
</tr>
<tr>
<td>07</td>
<td>Design of flat slabs</td>
<td>RV</td>
</tr>
<tr>
<td>08</td>
<td>Calculation of deflections</td>
<td>RV</td>
</tr>
<tr>
<td>09</td>
<td>Calculation of crack widths</td>
<td>RV</td>
</tr>
<tr>
<td>10</td>
<td>Revision</td>
<td>RV</td>
</tr>
</tbody>
</table>
3.0 Intended learning outcomes

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

- Build upon the material covered in Reinforced Concrete I.
- Have an in depth understanding of the design and behaviour of reinforced concrete structures and the related design clauses of Eurocode 2.

4.0 Teaching methods

A combination of lectures and tutorials.

5.0 Assessment

Assessment is through coursework and examination. There will be one piece of coursework which will involve the application of the taught material.

6.0 Recommended textbooks

Category as defined by Central Library:

C = Core, S = Supplementary

<table>
<thead>
<tr>
<th></th>
<th>Recommended reading in the form of technical guides, and reports which will be provided on Blackboard Learn.</th>
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7.0 Subject threads

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CI9-STR-11 Nonlinear Structural Analysis (CI3-333)

<table>
<thead>
<tr>
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<th>Professor Bassam Izzuddin</th>
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<tr>
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<td>Elective H2A2 (CS), H2A1 (GSE), H2U5 (SSD)</td>
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<td>Term:</td>
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<td>7</td>
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<tr>
<td>Assessment:</td>
<td>Coursework, written examination</td>
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1.0 Aims

- To present systematic procedures for geometric and material nonlinear structural analysis.
- To introduce and encourage the use of advanced nonlinear analysis software and to explore the significance of common nonlinear phenomena, particularly in relation to the structural response under extreme events.

2.0 Syllabus

- Fundamentals of geometric nonlinearity for discrete structural systems.
- Principles of stability and buckling analysis for discrete structural systems.
- Nonlinear solution procedures for tracing equilibrium paths.
- Geometrically nonlinear finite elements for one-dimensional structural systems.
- Materially nonlinear finite elements for one-dimensional structural systems.
- Nonlinear dynamic analysis of discrete structural systems (only MSc).

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<tr>
<th>No.</th>
<th>Topic</th>
<th>Staff</th>
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<tbody>
<tr>
<td>01</td>
<td>Lecture: Fundamentals of geometric nonlinearity for discrete structural systems</td>
<td>BAI</td>
</tr>
<tr>
<td>02</td>
<td>Lecture: Principles of stability and buckling analysis for discrete structural systems</td>
<td>BAI</td>
</tr>
<tr>
<td>03</td>
<td>Lecture: Principles of stability and buckling analysis for discrete structural systems Tutorial</td>
<td>BAI</td>
</tr>
<tr>
<td>04</td>
<td>Lecture: Principles of stability and buckling analysis for discrete structural systems Tutorial</td>
<td>BAI</td>
</tr>
<tr>
<td>05</td>
<td>Lecture: Nonlinear solution procedures for tracing equilibrium paths</td>
<td>BAI</td>
</tr>
</tbody>
</table>
### 3.0 Intended learning outcomes

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

- Distinguish between linear and nonlinear structural analysis.
- Recognise types of problem for which nonlinear structural analysis is necessary.
- Understand principles of stability for multi-degree of freedom structural systems.
- Appreciate the basis of sophisticated and simplified buckling analysis methods.
- Use equilibrium paths to characterise the nonlinear structural response.
- Understand basic incremental iterative solution procedures for tracing equilibrium paths.
- Appreciate the fundamentals of nonlinear finite element discretisation, including geometric and material nonlinearity.
- Appreciate the use of hierarchic processes in tackling complex problems.
- Recognise the role of analogies in gaining greater understanding.
- Use nonlinear structural analysis software.
- Perform simplified buckling analysis.
- Use computers for simulations.
- Solve a nonlinear system of equations.
- Apply techniques of linear algebra.

### 4.0 Teaching methods

Handouts are provided for the various topics, and extensive use is made of the visualiser to elaborate on concepts and application issues. All material, including handouts, visualiser lecture notes and solutions to
tutorial problems, are placed on Blackboard for student access. Computer laboratory sessions are also provided making use of screen projection to introduce finite element analysis software.

5.0 Assessment

Assessment will be via coursework and written examination.

6.0 Recommended textbooks

Category as defined by Central Library:

C = Core, S = Supplementary

| X | No textbooks are recommended. |

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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</table>
CI9-STR-13 Seismic Design of Concrete Structures

**Course leader:** Professor Ahmed Elghazouli

**Other contributors:** Dr Lorenzo Macorini, Dr Damian Grant, Edmund Booth

**Module status:** Core H2A3 (EQ), Elective H2A2 (CS), H2U2 (CSBM), H2U6 (CSSD)

**Pre- or co-requisites:**

**Term:** Spring

**Contact hours:** 30

**ECTS units:** 5

**FHEQ Level:** 7

**Assessment:** Written examination

### 1.0 Aims

- To introduce the students to the fundamental concepts and principles required for the seismic design of reinforced concrete and masonry structures.
- To enable the students to develop an understanding of the seismic behaviour of concrete and masonry materials, components and systems under typical earthquake loading conditions.
- This knowledge can then be applied in practical earthquake resistant design of frame and wall systems according to modern codified regulations, with particular emphasis on the European seismic design code, Eurocode 8.

### 2.0 Syllabus

- Introduction to the design of earthquake-resistant building structures in relation to the characteristics of different structural forms in reinforced concrete.
- Overview of codified procedures for the seismic design of concrete structures with emphasis on the provisions of Eurocode 8.
- Assessment of curvature, rotational and displacement ductility supply and demand in reinforced concrete members.
- Design and detailing of concrete members and joints in moment frames according to the recommendations of Eurocode 8.
- Behaviour and design of reinforced-concrete shear wall systems under seismic loading conditions with application to Eurocode 8.
- Performance and design of masonry structures and masonry-infilled frames under lateral seismic loads.
- Estimation of the flexural stiffness of concrete elements under seismic loading.
- Introduction to displacement-based seismic design.
Overview of key concepts relating to the seismic design of concrete diaphragms and foundations.

Overview of key concepts relating to the seismic repair and upgrading of reinforced concrete and masonry structures.

<table>
<thead>
<tr>
<th>No.</th>
<th>Topic</th>
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<tbody>
<tr>
<td>01</td>
<td>Introduction</td>
<td>AE/EB</td>
</tr>
<tr>
<td>02</td>
<td>General Design Considerations</td>
<td>AE/EB</td>
</tr>
<tr>
<td>03</td>
<td>Seismic analysis procedures</td>
<td>AE/EB</td>
</tr>
<tr>
<td>04</td>
<td>Force and displacement criteria</td>
<td>EB/DG</td>
</tr>
<tr>
<td>05</td>
<td>Principles of RC design</td>
<td>EB/DG</td>
</tr>
<tr>
<td>06</td>
<td>Design of RC buildings</td>
<td>EB/LM</td>
</tr>
<tr>
<td>07</td>
<td>Detailing of RC structures</td>
<td>LM/EB</td>
</tr>
<tr>
<td>08</td>
<td>Behaviour of Masonry structures</td>
<td>LM/EB</td>
</tr>
<tr>
<td>09</td>
<td>Design of Masonry structures</td>
<td>LM/EB</td>
</tr>
<tr>
<td>10</td>
<td>Principles of repair and upgrading</td>
<td>EB/LM</td>
</tr>
</tbody>
</table>

3.0 Intended learning outcomes

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

- Understand the response characteristics of typical materials, members and components under cyclic and earthquake loads.
- Estimate the curvature and deformation ductilities of critical structural members and components, and their use within seismic design procedures.
- Understand the concept of performance based seismic design and the means of achieving performance goals in buildings.
- Appreciate the key behavioural characteristics of concrete frame and wall systems under cyclic and earthquake loads.
- Understand basic concepts of scheme design of concrete and masonry buildings for earthquake resistance.
- Understand basic concepts of seismic design of concrete diaphragms and foundations.
- Apply the main design rules and detailing requirements for frame and wall systems according to the provisions of Eurocode 8.
- Have a general understanding of the methods adopted for the seismic repair and strengthening of building structures.

4.0 Teaching methods

The module involves a series of lectures and tutorials, with additional practical exercises to be completed by the students in their own time.
5.0 Assessment

Assessment is by written examination only.

6.0 Recommended textbooks

Category as defined by Central Library:

C = Core, S = Supplementary

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<thead>
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<tbody>
<tr>
<td>S</td>
<td>Seismic design of reinforced concrete structures: Eurocode 8</td>
</tr>
<tr>
<td>S</td>
<td>Seismic design of reinforced concrete structures: General</td>
</tr>
<tr>
<td>S</td>
<td>Seismic rehabilitation of buildings</td>
</tr>
<tr>
<td></td>
<td>12. ASCE 41-06. Seismic rehabilitation of existing buildings. American Society of Civil Engineers Standard. NB: A new combined version of these two standards is expected to appear in 2014.</td>
</tr>
<tr>
<td>S</td>
<td>Seismic design and analysis issues</td>
</tr>
</tbody>
</table>
|   | 13. Priestley MJN, Calvi GM and Kowalsky MJ. Displacement-based seismic
### Subject threads

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The table is subject to change during the academic year. Please check the Department website for the most up-to-date version.
1.0 Aims

Undertaken over the final four months of the course, students will aim to complete either:

1. one group-based conceptual design project and a detailed individual design project, or
2. one group-based conceptual design project and a research-oriented dissertation

Both the Conceptual and Detailed Design projects may be undertaken in the design of a steel or concrete building, or a bridge.

The principle aim of the Design Project – Dissertation is to assess the capability of students to undertake independent research-based work. While the research focus of the dissertations is relatively clear, the detailed individual design projects also include a significant component of research.

2.0 Syllabus

During the course of this module students will complete the following projects:

Conceptual design project: a group exercise conducted over a two-week period that requires teams of students to propose conceptual designs for particular problems dictated by a given brief. All students are required to complete one of these projects prior to commencing their detailed design project or research dissertation.

Detailed design project: a major design project involving detailed design of a complete structure. Students are required to submit a detailed written report and give an oral presentation. The aim of this project is to give students the opportunity to apply the knowledge they have accumulated from the taught modules and to gain experience in tackling the design of a complete system. The projects also include a research component that accounts for 30% of the final grade.
Research dissertation: the purpose of this work is to develop skills in tackling challenging technical problems at a fundamental level, under the supervision of a member of the academic staff and culminating in a formal dissertation and oral examination. The standard of work required is similar to that for a refereed publication.

Part-time students can start preparing for their dissertation/project (reading, collecting information, learning tools, etc.) at any stage during their studies. However, we expect the main part of conducting the work to be during the last year of the course, including the submission/assessment, as only then will these students have completed all of their taught components.

Part time students should follow exactly the same timetable for design projects, including submission date, as full time students.

Information Note:

Unlike plagiarism, which equates to copying, collaboration is a professional skill that is encouraged: it should involve mutual effort. Where coursework is specifically set as Group Work, the collaboration will involve the presentation by two or more students of a single report, together with related drawings and calculations, as the joint work of the group. Most coursework, however, is intended to be Individual Work, submitted under the name of a single student. Collaboration may involve you discussing with other students the intention of the project brief, ways and methods of carrying out the investigation and possible sources of reference. However, the obtaining of results, by observation or calculation, must be your own individual work, as must be the report, drawings etc. in which you present the results of your investigation.

The Conceptual Projects are joint- or group work whereas the Detailed Design Projects and Research Dissertations are individual.

3.0 Intended learning outcomes

Students should finish this module having gained a deep understanding of the topic on which they have decided to write their dissertation/project. They will have developed skills in overcoming technical problems, presenting their work and in applying the knowledge they have learnt in taught modules to conduct research and compose their own work. In addition to students applying material they have been exposed to during their taught modules, the students will almost certainly develop new skills relevant for their particular topic that will extend far beyond the taught modules. This may include learning new pieces of software, programming languages, analytical approaches, and experimental techniques, among others.

4.0 Teaching methods

Conceptual design project: Students attend a project induction session and two tutorial workshops over the two weeks of the project, which culminates in a presentation attended by all students and a minimum
of two assessors, one being the project coordinator. Attendance at all sessions is compulsory and all students are required to attend the presentations on the final day and also to take part in the presentations.

**Detailed design project:** Students undertaking these projects commit to a rigid framework of attendance, starting with the project induction and then weekly tutorial workshops for the first (normally) five weeks of the project. Attendance is compulsory. For those students undertaking the Detailed Design of a Tall Building (Steel) project, students must demonstrate to the project leader a good foundation in Structural Dynamics at undergraduate level or attendance at the autumn term Structural Dynamics module as a compulsory pre-requisite.

**Research Dissertation:** You will be supported by your personal supervisor who will oversee your progress and offer any assistance you may require.

A training workshop is provided by the Library staff on the use of referencing software and the avoidance of poor academic practice.

**Information Note: Attendance**

*Students are subject to the same attendance requirements during the course of the project element of the programme as with the taught element.*

### 5.0 Assessment

<table>
<thead>
<tr>
<th></th>
<th>Total Marks Allocated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conceptual Project</td>
<td>30</td>
</tr>
<tr>
<td>Detailed Project or Dissertation</td>
<td>270</td>
</tr>
</tbody>
</table>

A single mark is returned on your degree transcript which will be in percentage format.

**Conceptual Design Project** students will present their design to an audience of academic staff and their peers. All students within each group must present and participate.

**Individual Design Project** students will present their design to an audience of academic staff and their peers.

**Dissertation students** will undertake an oral (*viva voce*) exam involving the supervisor and an internal examiner drawn from the Board of Examiners.

All work is double-marked and subject to review by both External Examiners for the Advanced Structural Engineering MSc cluster.

**Information Note ~ Failure in Project-Dissertation**
This is potentially more serious than examination failure for the following reasons:

- Access to further supervision is not offered to the same level as during the first attempt;
- Access to College facilities, i.e. libraries, computing and software, is likely to be limited;
- Visa restrictions may complicate interaction with staff;
- Peer support will normally not exist.

**Criteria for the Marking of Projects, Dissertations and Coursework Exercises**

In the case of major projects/dissertations, assessment should first be made under four general categories:

1. Evidence of enquiry, creative ability, critical thought
2. Level of understanding
3. Level of effort, competence and quality
4. Clarity and style of presentation (including Viva-Voce)

Particular value should be attached to work that is regarded as intellectually challenging. The project/dissertation should then be considered as a whole and its features matched against the written criteria as a benchmark.

<table>
<thead>
<tr>
<th>Mark</th>
<th>Grade</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>85-100</td>
<td>A*</td>
<td>Distinction Standard: Outstanding achievement and presentation beyond the expectation of the supervisor, and making little demand for supervisory support.</td>
</tr>
<tr>
<td>70-84</td>
<td>A</td>
<td>Distinction Standard: Excellent work and presentation; substantial level of independent enquiry, of critical thought or creative ability.</td>
</tr>
<tr>
<td>60-69</td>
<td>B</td>
<td>Good: Well organised, clearly presented and adequately detailed; thorough grasp of relevant principles; some evidence of independent enquiry, of critical thought or creative ability; assessment of alternative solutions, designs or approaches.</td>
</tr>
<tr>
<td>50-59</td>
<td>C</td>
<td>Pass: Substantially correct; basic understanding of relevant principles; some evidence of enquiry; substantially competent in design, calculation and organisation; modest evidence of creative or critical ability; adequately presented; adequate level of consistent effort.</td>
</tr>
<tr>
<td>40-49</td>
<td>D</td>
<td>Unsatisfactory/Borderline: Some elements correct; incomplete understanding of relevant principles; some competence in routine tasks; somewhat lacking in presentation or in the application of consistent effort. Just acceptable.</td>
</tr>
</tbody>
</table>
| 30-39 | E | Possibly recoverable: Work displaying little or no understanding of the relevant principles; failure to develop an
Selection Process

**Conceptual Design** ~ your choice of project is nominally free, although there are limits in place on total numbers and preferred groups sizes. You will be asked to indicate your choice of project in order of preference. In the event that a project is over-subscribed your Student Course Representatives will be asked to assist with the final allocations.

For those of you who will be undertaking a Detailed Design Project rather than a Research Dissertation, there is NO requirement that you take the related Conceptual project, i.e., concrete detailed design students need not have taken the concrete conceptual project. In fact, it is an opportunity for you to cover a broader syllabus.

The nominal caps and group sizes are:

- Steel Conceptual (Groups of 5 students, maximum 6 groups) - Cap of 30
- Concrete Conceptual (Groups of 4 members)
- Bridge Conceptual (Groups of 5 students, maximum of 6 groups) - Cap of 30

**Dissertation-Design Project** ~ the allocation of students to either the detailed design project, or to a dissertation topic takes place towards the end of the spring term. Each year three detailed design projects are offered, with a nominal cap on student numbers of 12 students per project. The particular brief for each of these projects varies each year. The research dissertations naturally vary more significantly from year to year. The particular topics that can be undertaken can be defined in two ways. The principle way is that academic staff provide a list of topics that is circulated to the students. The students may then express interest in particular topics, and for a limited period of time there is an opportunity to reach an agreement with the relevant academic for a student to be allocated to this topic. Students can also, through discussion with an appropriate academic, propose their own area of investigation. Input from a member of academic staff is crucial if following this route in order to ensure an appropriate scope and level of difficulty is targeted from the outset.

<table>
<thead>
<tr>
<th>Project Title</th>
<th>Available to</th>
<th>Pre-requisite modules</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design of a Bridge</td>
<td>All courses</td>
<td>Design of Bridges (CI9-STR-35)</td>
</tr>
<tr>
<td>Design of Concrete Building</td>
<td>All courses excepting Structural Steel Design</td>
<td>Reinforced Concrete I (CI9-STR-02) Reinforced Concrete II (CI9-STR-09)</td>
</tr>
<tr>
<td>Design of Steel Building</td>
<td>All courses excepting Concrete Structures</td>
<td>Structural Dynamics (CI9-STR-08) Steel Buildings (CI9-STR-25)</td>
</tr>
</tbody>
</table>
Students that are unable to secure an agreement with a particular academic to undertake one of the design projects or dissertation topics are then allocated to topics following a system that considers the preferences of the students, among other constraints. The overwhelming majority of students tend to be allocated the topic that they are most interested in.

Specific details about the above process are circulated during the spring term and the process is also described verbally at an earlier date.

### 6.0 Recommended textbooks

There are no specific textbooks, but detailed guidelines will be provided for the layout, presentation and submission of dissertations.

Specification Documents (Project Briefs) are provided for the Detailed Design Projects. These include all instructions on layout and presentation. Submission information is also provided.

All students are required to submit electronic copies of their submission to a Turnitin-enabled Dropbox via the Blackboard Learn VLE. These are set up in advance and will give students the opportunity to undertake multiple submissions in advance of final submission. Library staff provide backup and clinics for students in the interpretation of the Similarity Indices generated by the Turnitin software.

### 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></th>
<th>Design</th>
<th>Health &amp; Safety Risk Management</th>
<th>Sustainability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design Project</td>
<td>P</td>
<td>C</td>
<td>S</td>
</tr>
<tr>
<td>Dissertation Project</td>
<td>S</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>
CI9-STR-19 Steel Components

<table>
<thead>
<tr>
<th>Course leader:</th>
<th>Professor Leroy Gardner</th>
</tr>
</thead>
<tbody>
<tr>
<td>Other contributors:</td>
<td>Dr Lorenzo Macorini</td>
</tr>
<tr>
<td>Module status:</td>
<td>Earthquake (Core) – General (Core) – SSD (Core)</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>
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</tr>
<tr>
<td>ECTS units:</td>
<td>5</td>
</tr>
<tr>
<td>FHEQ Level:</td>
<td>7</td>
</tr>
<tr>
<td>Assessment:</td>
<td>Examination</td>
</tr>
</tbody>
</table>

### 1.0 Aims
- To understand the behaviour of steel structures.
- To be able to design structural steel members and connections.

### 2.0 Syllabus

<table>
<thead>
<tr>
<th>Session</th>
<th>Topic</th>
<th>Staff</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>Introduction, background to codes and design philosophy</td>
<td>Professor Gardner</td>
</tr>
<tr>
<td>02</td>
<td>Tension members, local buckling and cross-section classification</td>
<td>Professor Gardner</td>
</tr>
<tr>
<td>03</td>
<td>Behaviour and design of compression members</td>
<td>Professor Gardner</td>
</tr>
<tr>
<td>04</td>
<td>Behaviour and design of beams</td>
<td>Professor Gardner</td>
</tr>
<tr>
<td>05</td>
<td>Introduction to beam-columns and frames</td>
<td>Professor Gardner</td>
</tr>
<tr>
<td>06</td>
<td>Introduction to connection design</td>
<td>Dr Macorini</td>
</tr>
<tr>
<td>07</td>
<td>Design considerations for bolted connections</td>
<td>Dr Macorini</td>
</tr>
<tr>
<td>08</td>
<td>Design considerations for welded connections</td>
<td>Dr Macorini</td>
</tr>
<tr>
<td>09</td>
<td>Analysis of bolt and weld groups</td>
<td>Dr Macorini</td>
</tr>
<tr>
<td>10</td>
<td>Special connection configurations</td>
<td>Dr Macorini</td>
</tr>
</tbody>
</table>

### 3.0 Intended learning outcomes

On successfully completing this course unit, students will be able to:
- Understand the behaviour of steel structures.
- Design structural steel members and connections.
4.0 Teaching methods

A mixture of lectures and tutorials focusing on:

- Introduction to design philosophy, structural analysis and basis of codes of practice.
- Design of steel components: local buckling, cross-section classification, design of tension members, compression members, beams and beam-columns.
- Design of steel connections: general consideration of bolts and welds, analysis and design of connections.

5.0 Assessment

<table>
<thead>
<tr>
<th>Total Marks Allocated</th>
<th>100</th>
</tr>
</thead>
<tbody>
<tr>
<td>Examination / Coursework split</td>
<td>100% / 0%</td>
</tr>
</tbody>
</table>

Rubric Answer three questions only (of four). All questions carry equal marks. You are required to bring EN1993-1-1 (only); data sheet is attached. Use a separate answer book for each question.

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).

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>-</td>
</tr>
</tbody>
</table>
CI9-STR-21 Seismic Design of Steel Structures

<table>
<thead>
<tr>
<th>Course leader:</th>
<th>Professor Ahmed Elghazouli</th>
</tr>
</thead>
<tbody>
<tr>
<td>Other contributors:</td>
<td></td>
</tr>
<tr>
<td>Module status:</td>
<td>Core H2A3 (EQ)</td>
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<td></td>
<td>Elective H2U5 (SSD), H2U7 (SSDBM), H2U9 (SSSD)</td>
</tr>
<tr>
<td>Pre- or co-requisites:</td>
<td>Spring</td>
</tr>
<tr>
<td>Term:</td>
<td>Spring</td>
</tr>
<tr>
<td>Contact hours:</td>
<td>30</td>
</tr>
<tr>
<td>ECTS units:</td>
<td>5</td>
</tr>
<tr>
<td>FHEQ Level:</td>
<td>7</td>
</tr>
<tr>
<td>Assessment:</td>
<td>Coursework, written examination</td>
</tr>
</tbody>
</table>

1.0 Aims

- To introduce the students to the fundamental concepts and principles required for the seismic design of steel structures.
- To enable the student to develop an understanding of the seismic behaviour of steel members, connections and systems under typical earthquake loading conditions. This knowledge can then be applied in practical earthquake resistant design of common forms of steel structures according to modern codified regulations, with particular emphasis on the European seismic design code, Eurocode 8.

2.0 Syllabus

- Observations from post-earthquake field observations with emphasis on common damage patterns in steel structures.
- Brief revision of structural dynamics principles for single and multi-degree of freedom systems for the case of applied base excitations.
- Structural analysis methods for the seismic response assessment of building structures including review of fundamental structural dynamics concepts.
- Overview of the principles of performance-based seismic design, failure mode control and capacity design.
- Introduction to the design of earthquake-resistant building structures in relation to the characteristics of different structural forms in steel structures.
- Assessment of the seismic behaviour of steel materials, members and connections to cyclic and seismic loading conditions.
- Overview of codified procedures for the seismic design of steel structures with emphasis on the provisions of Eurocode 8.
- Design of moment resisting steel frames according to the provisions of the European seismic code, Eurocode 8.
• Design of concentrically braced steel frames according to the provisions of the European seismic code, Eurocode 8.
• Design of eccentrically braced steel frames according to the provisions of the European seismic code, Eurocode 8.

<table>
<thead>
<tr>
<th>No.</th>
<th>Topic</th>
<th>Staff</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>Introduction</td>
<td>AE</td>
</tr>
<tr>
<td>02</td>
<td>General design considerations</td>
<td>AE</td>
</tr>
<tr>
<td>03</td>
<td>Seismic analysis procedures</td>
<td>AE</td>
</tr>
<tr>
<td>04</td>
<td>Seismic loading principles</td>
<td>AE</td>
</tr>
<tr>
<td>05</td>
<td>Behaviour of steel components</td>
<td>AE</td>
</tr>
<tr>
<td>06</td>
<td>Moment frame systems</td>
<td>AE</td>
</tr>
<tr>
<td>07</td>
<td>Concentrically braced frames</td>
<td>AE</td>
</tr>
<tr>
<td>08</td>
<td>Eccentrically braced frames</td>
<td>AE</td>
</tr>
<tr>
<td>09</td>
<td>Design project</td>
<td>AE</td>
</tr>
<tr>
<td>10</td>
<td>Design project</td>
<td>AE</td>
</tr>
</tbody>
</table>

3.0  **Intended learning outcomes**

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

• Determine seismic actions on typical steel structures using simplified methods derived from fundamental structural dynamics concepts.
• Identify suitable lateral resisting systems which are capable of providing effective earthquake resistance for steel building structures.
• Understand the response characteristics of typical steel members and connections under cyclic and earthquake loads.
• Appreciate the typical damage patterns that are observed in steel structures on the basis of experience from previous seismic events.
• Understand the concepts of capacity design and failure mode control and their deployment in modern codes of practice including Eurocode 8.
• Understand the main behavioural features of moment and braced steel frames under seismic loading conditions.
• Apply the main design rules and detailing requirements for moment resisting and braced steel systems according to the provisions of Eurocode 8.

4.0  **Teaching methods**

The module involves a series of lectures and tutorials, as well as design examples and exercises covering the practical aspects of the subject.

5.0  **Assessment**

Assessment will be via coursework and written examination.
6.0 Recommended textbooks

Category as defined by Central Library:

C = Core, S = Supplementary

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></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>
<th>Sustainability</th>
</tr>
</thead>
<tbody>
<tr>
<td>P</td>
<td>C</td>
<td>-</td>
</tr>
</tbody>
</table>
1.0 Aims

- To give students a rigorous grounding in the behaviour of structural components and systems that suffer from failure due to geometric, rather than material, nonlinearity; the principal features being that failure primarily occurs in the elastic range and due to buckling. It is a course based on fundamental mechanics that is designed to give the theoretical background to the more practical design-based modules.

2.0 Syllabus

- Instabilities in struts and columns: direct equilibrium and energy formulations; Euler load and the elastica; effective length concept. Approximate methods of analysis: Rayleigh and Timoshenko methods. Analysis of real columns using the Perry-Robertson formulation and the description of the method for designing steel columns in Eurocode 3.
- Multiple degree-of-freedom elastic systems: General Theory approach; diagonalised systems; elimination of passive coordinates; non-trivial fundamental paths; an introduction to mode interaction through a case study.
- Instabilities in beams: direct equilibrium and energy formulations, critical moment for lateral-torsional buckling, general loading cases and effective lengths and the description of the method for designing steel beams in Eurocode 3.
- Instabilities in rigid framed structures: analysis using stability functions and limitations.
- Instabilities in plates: critical and post-buckling of plated structures under compression and shear.
<table>
<thead>
<tr>
<th>No.</th>
<th>Topic</th>
<th>Staff</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>Introduction to Stability Concepts. Potential energy methods.</td>
<td>MAW</td>
</tr>
<tr>
<td>02</td>
<td>Perfect elastic systems: continuous and discrete models. Concept of strain energy from direct and bending strains. Classification of post-buckling behaviour.</td>
<td>MAW</td>
</tr>
<tr>
<td>03</td>
<td>Analysis of systems with imperfections. Imperfection sensitivities for different post-buckling responses.</td>
<td>MAW</td>
</tr>
<tr>
<td>04</td>
<td>Struts and Columns: Perfect column and effective lengths. Approximate analytical methods. Imperfect columns: behaviour and design.</td>
<td>MAW</td>
</tr>
<tr>
<td>05</td>
<td>Struts and Columns: Perfect column and effective lengths. Approximate analytical methods. Imperfect columns: behaviour and design.</td>
<td>MAW</td>
</tr>
<tr>
<td>06</td>
<td>General Theory: Perturbation methods.</td>
<td>MAW</td>
</tr>
<tr>
<td>07</td>
<td>Multiple degree-of-freedom systems: Diagonalisation, Multiple degree-of-freedom systems: Elimination of passive coordinates. Non-trivial fundamental paths.</td>
<td>MAW</td>
</tr>
<tr>
<td>08</td>
<td>Lateral-torsional buckling of beams: Behaviour and design.</td>
<td>MAW</td>
</tr>
<tr>
<td>09</td>
<td>Frame buckling: Stability functions.</td>
<td>MAW</td>
</tr>
<tr>
<td>10</td>
<td>Plate buckling: Critical buckling under axial and shear stresses. Post-buckling analysis and collapse behaviour.</td>
<td>MAW</td>
</tr>
</tbody>
</table>

3.0 **Intended learning outcomes**

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

- A rigorous grounding in the theory of structural stability and nonlinear structural behaviour.
- An appreciation of the potential failure modes that can occur due to geometric nonlinearity.
- The techniques to classify post-buckling phenomena.
- The techniques to analyse geometrically perfect and imperfect systems for structural stability.
- An appreciation of the differences between linear and nonlinear buckling analysis.
- An understanding of how basic structural components and systems behave when they are subject to instability.
- The techniques to analyse basic structural components and systems that are susceptible to instability.
- An appreciation of the fundamental basis of design rules concerned with structural instability.

4.0 **Teaching methods**

Each session is 3 hours long. The course has lectures and supporting tutorials. Staff and GTAs will be available to answer specific questions.

5.0 **Assessment**

Assessment is by written examination only.
6.0  **Recommended textbooks**

Category as defined by Central Library:

C = Core, S = Supplementary

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
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</thead>
<tbody>
<tr>
<td>C</td>
<td>J. M.T. Thompson and G. W. Hunt, Elastic instability phenomena, 1984 (Wiley)</td>
<td></td>
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<tr>
<td>S</td>
<td>H. G. Allen and P. S. Bulson, Background to buckling, 1980 (McGraw-Hill)</td>
<td></td>
</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></th>
<th>Design</th>
<th>Health &amp; Safety Risk Management</th>
<th>Sustainability</th>
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</thead>
<tbody>
<tr>
<td>P</td>
<td>P</td>
<td>C</td>
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</table>
CI9-STR-25 Design of Steel Buildings

<table>
<thead>
<tr>
<th>Course leader:</th>
<th>Dr Luke Louca</th>
</tr>
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<tbody>
<tr>
<td>Other contributors:</td>
<td>Reuben Brambleby</td>
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<td>Module status:</td>
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<tr>
<td>Pre- or co-requisites:</td>
<td>CI9-STR-24, CI9-STR-19, CI9-STR-34</td>
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<td>Term:</td>
<td>Spring</td>
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<td>Contact hours:</td>
<td>30</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, written examination</td>
</tr>
</tbody>
</table>

1.0 Aims

- To teach the fundamentals of the conceptual design of a range of structural framing systems used in the construction sector. This is achieved through issues related to structural form and behaviour, analysis, practical considerations in steel fabrication and codification using EC3.
- To integrate some of the structural analysis studied previously such that it can be used to provide approximate and quick design methods for guidance on initial sizing.

2.0 Syllabus

- Introduction – steel construction and design.
- Case studies of structural failure.
- Simple Building Frame Design: Floor Systems; Behaviour of Bracing systems; Beam Column Behaviour.
- Trusses – Basics.
- Composite beams.
- Floor systems – morphology and vibrations.
- Tall Building systems.

<table>
<thead>
<tr>
<th>No.</th>
<th>Topic</th>
<th>Staff</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>Introduction, learning from failures</td>
<td>LL</td>
</tr>
<tr>
<td>02</td>
<td>Floor morphologies for multi-storey buildings, composite construction</td>
<td>LL</td>
</tr>
<tr>
<td>03</td>
<td>Composite construction</td>
<td>LL</td>
</tr>
<tr>
<td>04</td>
<td>global frame stability</td>
<td>LL</td>
</tr>
<tr>
<td>05</td>
<td>Behaviour of bracing systems</td>
<td>LL</td>
</tr>
<tr>
<td>06</td>
<td>Floor vibrations</td>
<td>LL</td>
</tr>
<tr>
<td>07</td>
<td>Tall buildings</td>
<td>LL</td>
</tr>
<tr>
<td>08</td>
<td>Workshop</td>
<td>LL/Mr R. Brambleby</td>
</tr>
<tr>
<td>09</td>
<td>Tall buildings</td>
<td>LL/Mr R. Brambley</td>
</tr>
<tr>
<td>10</td>
<td>Tutorial</td>
<td>LL/Mr R. Brambley</td>
</tr>
</tbody>
</table>
3.0  Intended learning outcomes

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

- Develop stable framing schemes for both low and high rise steel structures.
- Determine deflections of braced framed systems.
- Design braced frame systems using simple connection details.
- Understand the behaviour of composite floor morphologies.
- Carry out simple structural design computations for beam and column framed systems.

4.0  Teaching methods

The application of the design issues is assessed through a group based coursework exercise and an examination.

5.0  Assessment

Assessment will via coursework and written examination. Students are required to bring BS EN1993-1-1:2005 and the Section Table Booklet to the examination.

6.0  Recommended textbooks

Category as defined by Central Library:

C = Core, S = Supplementary

<table>
<thead>
<tr>
<th></th>
<th>The Behaviour and Design of Steel Structures to EC3, Trahair, NS, Bradford, MA, Nethercot, DA and Gardner L., Spon, 2008. £29</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>
<th>Sustainability</th>
</tr>
</thead>
<tbody>
<tr>
<td>P</td>
<td>C</td>
<td>-</td>
</tr>
</tbody>
</table>
CI9-STR-26 Plated Structures

<table>
<thead>
<tr>
<th>Course leader:</th>
<th>Professor Leroy Gardner</th>
</tr>
</thead>
<tbody>
<tr>
<td>Other contributors:</td>
<td></td>
</tr>
<tr>
<td>Module status:</td>
<td>General (Elective) – SSD (Elective)</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>30</td>
</tr>
<tr>
<td>ECTS units:</td>
<td>5</td>
</tr>
<tr>
<td>FHEQ Level:</td>
<td>7</td>
</tr>
<tr>
<td>Assessment:</td>
<td>Examination</td>
</tr>
</tbody>
</table>

1.0 Aims

- To understand the behaviour and design of plated steel structures.

2.0 Syllabus

<table>
<thead>
<tr>
<th>Session</th>
<th>Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>Small deflection theory of plates.</td>
</tr>
<tr>
<td>02</td>
<td>Plates with large deflections.</td>
</tr>
<tr>
<td>03</td>
<td>Elastic buckling and post-buckling of plates.</td>
</tr>
<tr>
<td>04</td>
<td>Collapse of plates in compression, imperfections, residual stresses.</td>
</tr>
<tr>
<td>05</td>
<td>Buckling of stiffened compression flanges.</td>
</tr>
<tr>
<td>06</td>
<td>Design of stiffened compression flanges.</td>
</tr>
<tr>
<td>07</td>
<td>Cold-formed steel design.</td>
</tr>
<tr>
<td>08</td>
<td>Behaviour of plate girders and tension field theory.</td>
</tr>
<tr>
<td>09</td>
<td>Design of plate girders.</td>
</tr>
<tr>
<td>10</td>
<td>Revision.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Staff</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Professor Gardner</td>
<td></td>
</tr>
<tr>
<td>Professor Gardner</td>
<td></td>
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<tr>
<td>Professor Gardner</td>
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<tr>
<td>Professor Gardner</td>
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<tr>
<td>Professor Gardner</td>
<td></td>
</tr>
<tr>
<td>Professor Gardner</td>
<td></td>
</tr>
</tbody>
</table>

3.0 Intended learning outcomes

By the end of the course, students should be able to:

- Understand the elastic buckling and post-buckling of plates under in-plane loading.
- To design stiffened compression flanges and plate girders.
4.0 Teaching methods

A mixture of lectures and tutorials focusing on:

- Large deflection plate theory; laterally loaded plates; elastic post-buckling of axially compressed perfect and imperfect plates.
- Collapse of plates in compression: effective width concept, effect of imperfections and residual stresses; code design.
- Stiffened plates in compression and bending: elastic buckling analysis, beam-column behaviour orthotropic action, local and overall buckling; design of compression flanges, slenderness limitations for stiffeners.
- Plate girders: critical buckling of plates in shear, tension field theory; design of plate girders under bending and shear.
- Box girders: plates under combined loading, web panel design, treatment of web stiffeners.

5.0 Assessment

<table>
<thead>
<tr>
<th>Total Marks Allocated</th>
<th>100</th>
</tr>
</thead>
<tbody>
<tr>
<td>Examination / Coursework split</td>
<td>100% / 0%</td>
</tr>
</tbody>
</table>

Rubric: Answer two questions only (of three). All questions carry equal marks. You are required to bring EN1993-1-1 and EN1993-1-5.

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).

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>-</td>
</tr>
</tbody>
</table>
CI9-STR-27 Structural Steel Technology

**Course leader:** Dr Briony Holmes (The Welding Institute)

**Other contributors:**

**Module status:** Core H2U5 (SSD), H2U7 (SSDBM), H2U9 (SSDSD)

**Pre- or co-requisites:**

**Term:** Autumn

**Contact hours:** 30

**ECTS units:** 5

**FHEQ Level:** 7

**Assessment:** Examination

1.0 **Aims**

- To understand structural steel physical metallurgy.
- To apply this knowledge to the manufacture of steels, including welding.
- To understand the factors leading to corrosion and brittle fracture of steel.

2.0 **Syllabus**

Underlying chemistry of steel alloys; steel manufacturing methods; microstructure development and the effect of heat treatments; properties of steels, including a qualitative treatment of brittle fracture; quality control principles; methods of fabrication; tolerances and workmanship; connection philosophy; welding technology; corrosion; non-destructive testing; use of relevant codes.

<table>
<thead>
<tr>
<th>Session</th>
<th>Topic</th>
<th>Staff</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lecture 01</td>
<td>The nature and properties of materials</td>
<td>Dr Briony Holmes</td>
</tr>
<tr>
<td>Lecture 02</td>
<td>Mechanical testing</td>
<td>Dr Briony Holmes</td>
</tr>
<tr>
<td>Lecture 03</td>
<td>Strengthening mechanisms</td>
<td>Dr Briony Holmes</td>
</tr>
<tr>
<td>Lecture 04</td>
<td>Phase diagrams, Fe-C phase diagram and heat treatment of steel</td>
<td>Dr Briony Holmes</td>
</tr>
<tr>
<td>Lecture 05</td>
<td>Phase transformations in steels, TTT and CCT Diagrams,</td>
<td>Dr Briony Holmes</td>
</tr>
<tr>
<td></td>
<td>hardenability and the effect of structure on properties</td>
<td></td>
</tr>
<tr>
<td>Lecture 06</td>
<td>Steelmaking</td>
<td>Dr Briony Holmes</td>
</tr>
<tr>
<td>Lecture 07</td>
<td>Solidification and welding</td>
<td>Dr Briony Holmes</td>
</tr>
<tr>
<td>Lecture 08</td>
<td>Weld defects and NDE inspection</td>
<td>Dr Briony Holmes</td>
</tr>
<tr>
<td>Lecture 09</td>
<td>Corrosion and corrosion protection</td>
<td>Dr Briony Holmes</td>
</tr>
<tr>
<td>Lecture 10</td>
<td>Brittle fracture</td>
<td>Dr Briony Holmes</td>
</tr>
</tbody>
</table>
3.0 Intended learning outcomes

On successfully completing this programme, students will have:

- Knowledge of the basics of steel metallurgy.
- An understanding of how to change the mechanical and corrosion properties of structural steel, including a basic understanding of how to assess steel for flaws.
- Knowledge of the manufacturing processes for steels and their effect on steel properties, including the effect of welding.
- Knowledge of corrosion processes and corrosion prevention techniques for steel structures.

4.0 Teaching methods

Teaching is primarily by lectures. There will be a visit to a university lab to illustrate some of the mechanical testing techniques used.

5.0 Assessment

<table>
<thead>
<tr>
<th>Total Marks Allocated</th>
<th>100</th>
</tr>
</thead>
<tbody>
<tr>
<td>Examination / Coursework split</td>
<td>100% / 0%</td>
</tr>
</tbody>
</table>

Rubric: Answer four questions from six; All questions carry equal marks.

6.0 Recommended textbooks

Category as defined by Central Library:

C = Core, S = Supplementary

| C | Foundations of Materials Science and Engineering, Smith, William; Hashemi, Javad; Smith, William F. |
| S | Steels: metallurgy and applications, Llewellyn, D. T. |
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>
</table>
1.0 Aims

This module is intended to bring all students to a similar level as far as fundamental structural analysis is concerned. It comprises three distinct parts: analysis of statically and kinematically indeterminate frame structures, mechanics of materials, and constitutive behaviour. The material is viewed as the ideal core knowledge that would be expected of postgraduate students with an undergraduate background in civil, mechanical or structural engineering.

The course is taught as a 10 week course, with 20 hours of lectures, and 10 hours of tutorials. Each 3 hour slot is divided as 2 hours lecture, 1 hour tutorial. Students will be expected to complete tutorials outside of scheduled contact hours. GTAs may be utilised during tutorial times. Material will be delivered primarily in the form of printed notes linked in with lecture slides and demonstrations. Some additional material will be made available through an online learning environment.

2.0 Syllabus

<table>
<thead>
<tr>
<th>Session</th>
<th>Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lecture 01</td>
<td>Introduction to common structural forms, including frame and truss analysis, calculation of internal forces, and assessment of simplified approaches to analysis. Introduction of the concept of virtual work.</td>
</tr>
<tr>
<td>Lecture 02</td>
<td>Assessment of kinematically and statically indeterminate structures. Introduction of the unit load method for finding the displacement of a structure under given loading.</td>
</tr>
<tr>
<td>Lecture 03</td>
<td>Continuation of week 2 with the introduction of the flexibility method.</td>
</tr>
<tr>
<td>Lecture 04</td>
<td>Continuation of weeks 2 and 3 with the introduction of the stiffness method.</td>
</tr>
</tbody>
</table>
### Lecture 05
Continuation of weeks 2, 3 and 4 with brief discussion of the similarities in the finite element approach to the stiffness method as applied to structural members.

### Lecture 06
Introduction to engineering (Euler-Bernoulli) beam bending theory, and discussion of Timoshenko beam theory in one dimension, and definition of elastic and plastic cross-sectional properties.

### Lecture 07
Evaluation of stresses present in structural components under biaxial bending, shear, torsion and warping.

### Lecture 08
Extension of Hooke’s law from 1D through to 3D. Introduction to the concept of principal stresses and strains, and tensor transformation. Application to strain gauge measurements.

### Lecture 09
Formulation of the stiffness and compliance matrices for anisotropic, orthotropic, trans-tropic and isotropic elastic materials. Plane stress and plane strain assumptions.

### Lecture 10
Introduction to plasticity. Von Mises, Mohr-Coulomb and Drucker-Prager yield criteria as applied in structural engineering. Upper and lower bound analysis methods.

### 3.0 Intended learning outcomes

It is intended that by the end of the course students should be able to analyses common structural forms using the flexibility and stiffness methods. In addition they should be aware of how to implement the matrix stiffness method using software such as Matlab, as well as being able to check their analyses using software such as Oasys GSA.

Students should have an understanding of the elastic behaviour of structural elements, including definition of sectional properties, asymmetric and biaxial bending, shear flow, torsion and warping. In particular students should appreciate the difference in formulations when operating in principal and non-principal axes. Students should have an understanding of the existence of alternative beam theories and be aware of the implicants of assumptions adopted when using Euler-Bernoulli beam theory.

Students should also have an understanding of the three dimensional behaviour of materials, including formulation of stiffness and compliance matrices, and implications of plane strain and plain strain assumptions. It is also intended to introduce plastic yield and plastic analysis with upper and lower bound methods at a basic level.

### 4.0 Teaching methods

A mixture of lectures and tutorials.
5.0 Assessment

Assessment information will be provided separately.

6.0 Recommended textbooks

Category as defined by Central Library:

C = Core, S = Supplementary

<table>
<thead>
<tr>
<th>C</th>
<th>Structural Analysis; Coates, Coutie and Kong</th>
</tr>
</thead>
<tbody>
<tr>
<td>S</td>
<td>Elasticity, Tensor, Dyadic and Engineering Approaches; Chou and Pagano</td>
</tr>
<tr>
<td>S</td>
<td>Mechanics of Materials; Gere and Goodno</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>
<th>Health &amp; Safety Risk Management</th>
<th>Sustainability</th>
</tr>
</thead>
<tbody>
<tr>
<td>S</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>
**CI9-STR-35 Design of Bridges**

**Course leader:** Dr Ana Ruiz-Teran  
**Other contributors:** Mr Ian Firth, Mr Carlos Bajo  
**Module status:** General (Elective) – Earthquake (Elective) – Concrete (Elective) – SSD (Elective)  
**Pre- or co-requisites:**  
**Term:** Spring  
**Contact hours:** 30  
**ECTS units:** 5  
**FHEQ Level:** 7  
**Assessment:** Coursework and Written examination

### 1.0 Aims

- To introduce students to the design and construction of bridges. This module covers the structural behaviour of the main longitudinal and transverse bridge typologies, the fundamental design principles, and main construction procedures for short, medium and long span bridges.

### 2.0 Syllabus

- The structural behaviour and design principles for the main longitudinal (such as beams, portal frames, arches, cable-stayed bridges, and suspension bridges) and transverse (such as beams, slabs, and box girders) bridge typologies.  
- The detailed design of prestressed concrete composite bridge decks, and steel-concrete composite bridge decks.  
- The design of different bridge components and elements (such as parapets, waterproofing, drainage, bearings, joints, abutments, piers, etc.).  
- The main bridge construction procedures.

<table>
<thead>
<tr>
<th>No.</th>
<th>Topic</th>
<th>Staff</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>Introduction to the module; aims, objectives and learning outcomes, contents, and schedule, assessment, general references; bridge infrastructure, functions and design requirements; platform types; waterproofing and surfacing parapets; drainage and services, and bearings; Joints, piers and abutments bridge design codes and standards</td>
<td>ART</td>
</tr>
<tr>
<td>02</td>
<td>Actions (pedestrian, road, railway bridges)</td>
<td>ART</td>
</tr>
<tr>
<td>03</td>
<td>Transverse schemes; beams; section types in structural concrete decks (precast and in-situ construction; T-beams; U-beams; transverse spacing) Section types in composite decks Advantages and disadvantages of this transverse scheme Transverse load distribution Structural behaviour under uniform distributed loads</td>
<td>ART</td>
</tr>
<tr>
<td>Module Descriptor 2016-17</td>
<td>Revised: 23-Aug-2016</td>
<td></td>
</tr>
<tr>
<td>---------------------------</td>
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<td></td>
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<tr>
<td>Structural behaviour under point loads</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transverse schemes. Slabs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Section types (solid and voided slabs)</td>
<td></td>
<td></td>
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<tr>
<td>Advantages and disadvantages of this transverse scheme</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transverse load distribution</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Voids geometry</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transverse sections in both variable-depth decks variable-width decks</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diaphragms at support sections</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transverse schemes. Box girders</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sections types for prestressed concrete, composite, and steel decks</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Advantages and disadvantages of this transverse scheme</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Structural behaviour under uniform distributed loads</td>
<td></td>
<td></td>
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<tr>
<td>Structural behaviour under point loads</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Effective width</td>
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<tr>
<td>Diaphragms</td>
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</table>

<table>
<thead>
<tr>
<th>04</th>
<th>Longitudinal schemes. Beams</th>
<th>ART</th>
</tr>
</thead>
<tbody>
<tr>
<td>Types</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Statically determinate beams (uniform depth, fish-belly shape, Gerber; advantages and disadvantages)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Statically non-determinate beams (constant/variable depth; advantages and disadvantages)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Appropriate transverse types for different span lengths</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Geometry of continuous bridges (constant/variable depth)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>End spans in continuous bridges</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coupled torsion and bending responses in curved beams</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Longitudinal schemes. Portal frames</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Advantages and disadvantages of this longitudinal scheme</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Types</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Longitudinal schemes. Arches</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Span ranges</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Types</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Antifunicularity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Superior deck arch bridges (links between elements; geometry; arch cross-sectional section; rigid and deck-stiffened arches)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inferior deck arch bridges / Tied arch bridges / Bow strings (behaviour; stays / hangers)</td>
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<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>05</th>
<th>Longitudinal schemes. Cable-stayed bridges</th>
<th>ART</th>
</tr>
</thead>
<tbody>
<tr>
<td>Span ranges</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Types</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Structural behaviour under permanent and live load</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Efficiency of cable-stayed bridges</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Longitudinal and transverse stay cable arrangement</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Deck cross-sectional sections (for different stay cable configurations; for different spans)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Tower types
- Configuration of cable-stayed bridges with two, three and multiple spans
- Ernst modulus
- Stay cables

### Longitudinal schemes. Suspension bridges
- FE models for structural analysis of bridges
- Grillage models for beams, slabs and box girders
- FEM

| 06 | Pretensioned and posttensioned concrete decks | ART |
| 07 | Composite decks with steel beams and concrete slabs | ART |
| 08 | Design of Bridges | IF |
| 09 | Construction of bridges | CB |
|     | In-situ and precast construction |
|     | Falsework, gantries and self-launching gantries |
|     | Span by span construction |
|     | Cantilever construction |
|     | Transverse launching |
|     | Longitudinal launching |
|     | Rotation |
|     | Redistribution of internal forces due to loads which are applied on temporary structural schemes in concrete bridges. |
| 10 | (if there is a 10th session available, the material will be divided in 10 sessions) | ART |

### 3.0 Intended learning outcomes

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

- Develop the conceptual design for short, medium and long span bridges.
- Understand the structural behaviour of the different longitudinal and transverse bridge types.
- Select appropriate longitudinal and transverse schemes for particular cases.
- Determinate the actions to be considered for the design of a bridge according to Eurocodes.
- Develop conventional models for structural analysis of bridges.
- Design a concrete or steel composite bridge deck of medium span according to Eurocodes.
- Selection of bearings, joints, piers and abutments.
- Select the appropriate construction method.

### 4.0 Teaching methods

A combination of lectures and tutorials.
5.0  **Assessment**

Assessment is via coursework and examination.

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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<th></th>
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</thead>
<tbody>
<tr>
<td>S</td>
<td>PARKE G, HEWSON N. 2008. ICE manual of bridge engineering. ICE.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>S</td>
<td>COLLINGS D. Steel concrete composite bridges.</td>
<td></td>
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</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).
CI9-STR-36 Structural Reliability Theory

<table>
<thead>
<tr>
<th>Course leader:</th>
<th>Dr Peter Stafford</th>
</tr>
</thead>
<tbody>
<tr>
<td>Other contributors:</td>
<td>Professor Haig Gulvanessian</td>
</tr>
<tr>
<td>Module status:</td>
<td>General (Elective) – Earthquake (Elective) – Concrete (Elective) – SSD (Elective)</td>
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<td>ECTS units:</td>
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<td>7</td>
</tr>
<tr>
<td>Assessment:</td>
<td>Written examination</td>
</tr>
</tbody>
</table>

1.0 Aims

- To introduce students to the fundamental concepts and principles of structural safety. The approach to assessing the safety of both new and existing structures is considered, with techniques relevant for the latter being emphasised.
- To introduce the students to the most common quantitative approaches of structural reliability theory as well as to enable students to understand how such quantitative probabilistic approaches manifest in codes of practice.
- While the principle aim of the course is to promote understanding of the methods of structural reliability theory, a secondary aim is for students to appreciate the power of probabilistic methods in structural engineering.

2.0 Syllabus

- Principles of Structural Safety.
- Fundamentals of Probability Theory: Univariate and multivariate probability distributions; Correlation; Bayesian inference; Probabilistic transformations; Combinations of random variables.
- Reliability Theory: Specification of limit-state functions; Cornell reliability index; Hasofer & Lind reliability index; Rosenblatt & Nataf transformations; Design points, FORM, SORM, linear and nonlinear limit state functions.
- Simulation techniques: Crude Monte Carlo, Latin Hypercube sampling, Importance sampling.
- System Reliability: Series systems, parallel systems, and k-out-of-n systems; Structure functions, cut sets and path sets; Correlated modes of failure; Failure domains for systems.
- Background to EN1990: Probabilistic formulations in codes, partial factors, safety factors, combination factors, loading levels; Prescriptions for robustness and progressive collapse.
- Life-cycle Analysis: Time-value of money; Cost-benefit analysis; Decision theory; Reliability profiles; Time-controlled and reliability-controlled maintenance strategies; Time-dependent capacity and loading, time-dependent reliability formulation.
3.0  Intended learning outcomes

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

- Understand the framework under which structural codes are developed, with particular reference to EN1990.
- Quantitatively describe loadings, in a probabilistic manner, for a variety of circumstances.
- Evaluate the nominal probability of failure of a structure using a time-independent reliability formulation.
- Employ a Bayesian framework to incorporate information from structural testing and inspection in order to modify models for structural capacity.
- Undertake First Order and Second Order reliability analyses for structural components.
- Apply simulation techniques, including crude Monte Carlo and Importance sampling, to evaluate the reliability of structural components or systems.
- Describe the capacity of structural systems using combinations of series, parallel and k-out-of-n subsystems.
- Understand the time-dependent nature of structural reliability and develop quantitative models for the time-dependent capacity of structures.
- Understand the key concepts of life-cycle cost analysis and to make considered judgements regarding optimal maintenance and/or repair strategies.
- Appreciate the power of probabilistic methods in structural engineering.
- Understand the concept of robustness and how this relates to preventing progressive collapse.
- Identify optimal values for partial factors and load factors in order to achieve a pre-determined level of reliability.

4.0  Teaching methods

A combination of lectures and tutorials.
5.0 **Assessment**

Assessment information will be provided separately.

6.0 **Recommended textbooks**

Category as defined by Central Library:

C = Core, S = Supplementary

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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>
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<tbody>
<tr>
<td>S</td>
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CI9-GEO-30 Geotechnical Hazards (CI4-452)
(CI9-STR-37)

<table>
<thead>
<tr>
<th>Course leader:</th>
<th>Dr Stavroula Kontoe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Other contributors:</td>
<td>Dr Peter Stafford</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>Contact hours:</td>
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<td>7</td>
</tr>
<tr>
<td>Assessment:</td>
<td>Written examination</td>
</tr>
</tbody>
</table>

1.0 Aims

- To introduce the students to fundamental elements of engineering seismology and seismic hazard assessment, including the effects of soil deposits at the site, as well as to present basic concepts concerning other geohazards, such as volcanoes, tsunamis and landslides.
- To enable the students to use hazard assessment as a generic tool which can be applied to all types of geohazards.

2.0 Syllabus

- Introduction to major Geohazards (volcanoes, tsunamis, ground shaking and landslides).
- Landslides (flows and mudslides): mechanisms, hazard zonation, monitoring, management and mitigation.
- Fundamentals of Engineering Seismology (ground motion parameters, source characterisation, recurrence relationships and ground motion prediction equations).
- Probabilistic Seismic Hazard Analyses (PSHA).
- Epistemic uncertainty and logic trees; seismic hazard and design codes.
- Fundamentals of wave propagation, dynamic soil properties and site effects.
- Site response analysis and its incorporation into PSHA.
- Liquefaction: mechanisms, assessment of hazard and estimation of liquefaction induced deformations.
- Seismic Slope Stability.
<table>
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<tr>
<th>No.</th>
<th>Topic</th>
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<tr>
<td>02</td>
<td>Seismic sources, types of earthquakes, earthquake characteristics.</td>
<td>PJS</td>
</tr>
<tr>
<td>03</td>
<td>Recurrence relationships, seismicity analysis, seismic recordings.</td>
<td>PJS</td>
</tr>
<tr>
<td>04</td>
<td>Strong motion engineering seismology.</td>
<td>PJS</td>
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<tr>
<td>05</td>
<td>Seismic Hazard Analysis.</td>
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</tr>
<tr>
<td>06</td>
<td>Epistemic uncertainty, representation in seismic codes.</td>
<td>PJS</td>
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<tr>
<td>07</td>
<td>Fundamentals of wave propagation, dynamic soil properties and site effects.</td>
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<td>08</td>
<td>Site response analysis and its incorporation into PSHA.</td>
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<tr>
<td>10</td>
<td>Seismic Slope Stability.</td>
<td>SK</td>
</tr>
</tbody>
</table>

### 3.0 Intended learning outcomes

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

- Understand major types of geotechnical/geological hazards: volcanoes, tsunamis, ground shaking, landslides.
- Describe approaches applied in hazard zonation, prediction and monitoring.
- Understand the mechanisms that trigger major landslides (mudslides and flows).
- Develop basic competence in assessing seismic hazard and in characterising earthquake actions.
- Evaluate the seismic response of soil layers.
- Evaluate the liquefaction potential using simplified methodologies.
- Estimate slope movements induced by seismic motion.

### 4.0 Teaching methods

A combination of lectures and tutorials.

### 5.0 Assessment

Assessment information will be provided separately.

### 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).

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

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CI9-GEO-13 Geotechnical Earthquake Engineering (CI9-STR-38)

<table>
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<tr>
<th>Course leader:</th>
<th>Dr Stavroula Kontoe</th>
</tr>
</thead>
<tbody>
<tr>
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<td>Dr Sarada K Sarma</td>
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<tr>
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</tr>
<tr>
<td>Assessment:</td>
<td>Coursework, written examination</td>
</tr>
</tbody>
</table>

1.0 Aims
- To introduce the student to the fundamentals of soil dynamics giving emphasis on the behaviour of soils under seismic and dynamic loading and on the effect of superficial geology on strong-motion. The coursework of the module will enable the student to perform an equivalent-linear site response analysis.

2.0 Syllabus
- Wave propagation and field measurement of dynamic soil properties.
- Basic dynamics
- Dynamic stress deformation and strength characteristics of soils.
- Liquefaction phenomenon, assessment of hazard and mitigation.
- Site response analysis.
- Seismic slope stability.
- Seismic design of geotechnical structures.
- Mini project on site response analysis.

<table>
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<tr>
<th>No.</th>
<th>Topic</th>
<th>Staff</th>
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<td>01</td>
<td>Wave Propagation and Basic Dynamics</td>
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<td>02</td>
<td>Dynamic Soil Properties</td>
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<tr>
<td>03</td>
<td>Liquefaction Phenomenon</td>
<td>SK</td>
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<tr>
<td>04</td>
<td>Liquefaction and Mitigation Measures</td>
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</tr>
<tr>
<td>05</td>
<td>Site Response Analysis – Analytical Solution</td>
<td>SK</td>
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<tr>
<td>06</td>
<td>Numerical Site Response Analysis</td>
<td>SK</td>
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<tr>
<td>07</td>
<td>Seismic Design of Geotechnical Structures</td>
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<tr>
<td>08</td>
<td>Dynamic Numerical Analysis of Geotechnical Structures</td>
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<tr>
<td>09</td>
<td>Seismic Slope Stability</td>
<td>SKS</td>
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</table>
3.0 **Intended learning outcomes**

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

- Understand the fundamental principles of wave propagation and apply them in engineering examples.
- Understand basic facets of soil behaviour under dynamic loading.
- Understand the role of soil deposits in modifying the seismic ground motion.
- Perform a site response analysis using analytical and numerical approaches.
- Evaluate the liquefaction potential using a range of simplified methodologies and understand the principles of mitigation measures.
- Understand the behaviour of soil slopes under seismic loading and the sliding block methodologies.

4.0 **Teaching methods**

A combination of lectures and tutorials.

5.0 **Assessment**

The assessment of the module is based on the final exam and on coursework.

6.0 **Recommended textbooks**

Category as defined by Central Library:

C = Core, S = Supplementary

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<tr>
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<td>C</td>
<td>Kramer, S L, Geotechnical Earthquake Engineering, Prentice-Hall, 1996</td>
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<td>S</td>
<td>Idriss, IM; Boulanger, Ross W; Soil liquefaction during earthquakes, Earthquake Engineering Research Institute, MNO-12, 2008</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).

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

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CI9-STR-39 Theory of Shells (CI3-337)

<table>
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<th>Dr Adam Jan Sadowski</th>
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<tr>
<td>Assessment:</td>
<td>Coursework, written examination</td>
</tr>
</tbody>
</table>

1.0 Aims

- To introduce the students to the fundamental concepts and principles of the analysis and design of thin-walled shelled structures.
- The module begins with an introduction to membrane theory for common shapes of axisymmetric structural shells, followed by an overview of axisymmetric bending theory for cylindrical shells and an introduction to the phenomenon of shell buckling.
- The module introduces the students to the analysis of shells using commercial finite element software including linear elastic, linear plastic, nonlinear elastic and linear buckling analyses. An introduction to the design of shells using EN 1993-1-6 is also given.

2.0 Syllabus

- Membrane theory of thin shells: Cylindrical, conical and spherical shells; Generalisation to other axisymmetric shells.
- Axisymmetric bending theory for cylindrical shells.
- Introduction to buckling of cylindrical shells.
- Introduction to the analysis of shell structures using finite element software and overview of linear elastic, linear plastic, linear buckling and nonlinear buckling analyses.
- Overview of structural design according to EN 1993-1-6.
- Overview of advanced research topics in shells.

<table>
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<th>Topic</th>
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<tr>
<td>01</td>
<td>Introduction – Membrane theory of cylindrical shells</td>
<td>AJS</td>
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<tr>
<td>02</td>
<td>Membrane theory and deformations of cylindrical shells</td>
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<td>03</td>
<td>Membrane theory of general shells of revolution – cylindrical shells</td>
<td>AJS</td>
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<tr>
<td>04</td>
<td>Membrane theory of spherical shells</td>
<td>AJS</td>
</tr>
<tr>
<td>05</td>
<td>Bending theory of cylindrical shells</td>
<td>AJS</td>
</tr>
<tr>
<td>06</td>
<td>Buckling of cylindrical shells and computational analyses</td>
<td>AJS</td>
</tr>
</tbody>
</table>
3.0 Intended learning outcomes

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

- Understand what is meant by a 'thin' walled assumption for axisymmetric shell structures.
- Apply shell membrane theory to analyse cylindrical, conical and spherical shells under varying load cases.
- Apply axisymmetric bending theory to perform stress analyses of isotropic and orthotropic cylindrical shells.
- Use numerical analysis to perform a series of increasingly sophisticated analyses on different types of shell structures, and to compare the outcomes to previously calculated membrane theory solutions.
- Become familiar with the design philosophy in EN 1993-1-6.

4.0 Teaching methods

The course consists of lectures and supporting tutorials.

5.0 Assessment

The final three weeks of the project consist of an advanced ABAQUS project, carried out in the computer lab. The exam consists of two questions, both mandatory and both carrying equal marks. The split between examination and coursework is 70% / 30%.

6.0 Recommended textbooks

Category as defined by Central Library:

C = Core, S = Supplementary

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<tbody>
<tr>
<td>S</td>
<td>Other relevant literature will be made available at different stages during the module.</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>
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<tr>
<td>S</td>
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</table>
1.0 Aims

- To introduce the students to the design of structures in timber and masonry.
- To enable students to develop an understanding of the fundamental concepts and design philosophies related to timber and masonry elements and to apply this knowledge to the design of conventional structures.

2.0 Syllabus

This course concerns the design of structures in two structural materials: timber and masonry.

- Design of Timber Structures:
  - Introduction to the design of timber structures.
  - Structural properties of wood and structural design philosophy.
  - Design of connections.
  - Design of complex beams.
  - Axially loaded members and design to combined bending and axial forces.
  - Design of composite (concrete/timber) members.
  - Fire response and design of wooden structures.
  - Cross-laminated timber diaphragms and walls.

- Design of Masonry Structures:
  - Basic components and mechanical characteristics of masonry.
  - Design of unreinforced masonry walls under gravitational and lateral loading.
  - Simplified design approach for masonry buildings.
  - Analysis of masonry arches.
3.0 Intended learning outcomes

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

- Understand the behaviour of timber structures.
- Design structural members and connections in timber.
- Understand the behaviour of unreinforced masonry structures.
- Design masonry components and bearing wall buildings.

4.0 Teaching methods

A combination of lectures and tutorials.

5.0 Assessment

Assessment by written examination and coursework.

6.0 Recommended textbooks

Category as defined by Central Library:

C = Core, S = Supplementary

<table>
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<tr>
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<tr>
<td></td>
<td>Porteous, J., Kermani, A. (2008). Structural timber design to Eurocode 5 Wiley- Black,</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).

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<td>P</td>
<td>C</td>
<td>C</td>
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</tbody>
</table>


1.0 Aims

- To introduce the students to the fundamental concepts and principles of structural fire safety engineering.

2.0 Syllabus

- Fundamentals of conductive, convective and radiative heat transfer.
- Introduction to fire science and fire dynamics – fire growth and spread.
- Mechanical and thermal properties of common construction materials under elevated temperatures.
- Structural behaviour of individual members and systems under thermal loads.
- Introduction to prescriptive fire design according to the Eurocodes.
- Limitation of prescriptive fire design and fire behaviour in large enclosures including travelling fires.
- Introduction to performance-based fire design with FE computational modelling.

<table>
<thead>
<tr>
<th>No.</th>
<th>Topic</th>
<th>Staff</th>
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<tbody>
<tr>
<td>01</td>
<td>Introduction to fire science, fire dynamics and heat transfer</td>
<td>GR</td>
</tr>
<tr>
<td>02</td>
<td>Fire growth and spread, characterisation in EN 1991-1-2</td>
<td>GR</td>
</tr>
<tr>
<td>03</td>
<td>Properties of common construction materials</td>
<td>AJS</td>
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<tr>
<td>04</td>
<td>Structural behaviour under thermal loads</td>
<td>AJS</td>
</tr>
<tr>
<td>05</td>
<td>Structural design for thermal loads</td>
<td>AJS</td>
</tr>
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<td>06</td>
<td>Performance-based fire design topic</td>
<td>AJS, GR</td>
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<td>07</td>
<td>Computational laboratory</td>
<td>AJS, GR</td>
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<tr>
<td>09</td>
<td>Computational laboratory</td>
<td>AJS, GR</td>
</tr>
</tbody>
</table>
3.0 Intended learning outcomes

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

- Understand the principles of heat transfer within and between structural members and the fire.
- Understand the mechanics of a compartment fire and travelling fire, and their associated thermal loads.
- Understand how common construction materials such as steel, concrete and timber degrade under the action of elevated temperatures.
- Be able to apply principles of fire science and heat transfer to perform simple design calculations using spreadsheet tools.
- Be familiar with using sophisticated numerical tools to undertake performance-based fire safety engineering computations.

4.0 Teaching methods

The module is delivered via a mixture of lectures and tutorials, with some guest lectures delivered by representatives from industry. The final three weeks of the module are comprised of an advanced Finite Element (FE) computational project, carried out in a computer lab.

5.0 Assessment

Assessment via coursework (30%) and written examination (70%).

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).

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