7. Health and Safety

Welcome pack
Good infection control
Hand sanitisers and multi-surface cleaning wipes
Social distancing
Face coverings
The College Safety Department
Occupational Health requirements
Security

8. College Policies and Procedures

Regulations for Students
Academic Feedback Policy
Provisional Marks Guidance
Late Submission Policy
Mitigating Circumstances
Academic Misconduct Policy and Procedures
Unsatisfactory Progress
Academic Appeals Procedure
Arithmetic Marks Check (Examinations and year results)
Marks Query Check (coursework and test marks)
Student Complaints
Student Disciplinary Procedure
Intellectual Property Rights Policy
Use of IT Facilities
General Data Protection Regulation (GDPR)

9. Wellbeing, Support and Advice

In your department
Your MSc Senior Tutor
Your Course Director/Deputy Course Director
The Materials Student Office Team Emails: queries etc.
Your Union
Student Hub
Student Support Zone
Useful support contacts

10. Student Records and Data

11. Work-life Balance

Graduate Students' Union
Move Imperial

12. Student feedback and representation
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 are now part of this prestigious community of discovery and we hope you will take this opportunity to make your own unique contribution.

We understand that this is a challenging time for our student community due to the impact of coronavirus and we are committed to providing you with the very best academic resources to enrich your experience. Information on teaching and learning, services and facilities to support the wider student experience during the Covid-19 pandemic can be found on the College’s webpages, alongside local information provided by your Department. 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 will 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 360 clubs, societies and projects is one of the largest of any UK university, making it easy to do something different with your downtime. Access to the gym and other sporting facilities will be dependent on government guidance. We are working to ensure that you have access to a variety of resources online to support your health and wellbeing if there are restrictions.

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

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

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

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

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

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

www.imperial.ac.uk/students/our-principles
Welcome to Imperial College London and the Graduate School!

The Graduate School is responsible for the postgraduate experience at the College and we work closely with the Union and the Graduate Students' Union to ensure that when decisions are being made, which affect your time at Imperial, your voice is heard.

Another important aspect of our role is to offer you a free and exciting range of professional development opportunities which you can access wherever you are in the world.

Our team of tutors have a variety of research and other career experiences. We understand the importance of developing professional skills and our programmes will help you to progress in your academic studies and research and will prepare you for your future career. Whether you wish to pursue a career in academia, industry or something else, professional development training will improve your personal impact. You will also get to meet students from other Departments when attending our courses.

The Graduate School runs exciting competitions throughout the year which are an opportunity to broaden your knowledge as well as to meet other students and have fun. Our primary way to communicate to you will be through our monthly newsletter. However, do check our website, blog and social media platforms to keep up to date with all the latest activities available to you.

Finally, Imperial College is an extremely exciting, stimulating and diverse environment in which to work, to study and to research. Do make the most of all that the College and your programme has to offer.
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/students/masters/](http://www.imperial.ac.uk/study/pg/graduate-school/students/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)
Welcome from the Graduate Students’ Union (GSU)

I am delighted to welcome you to the Imperial College and the Graduate Students’ Union (GSU). I hope you have a fantastic time here.

The Graduate Students’ Union is a university-wide representative body elected by postgraduate students. Our job is to stand up for your interest as a postgraduate and ensure that you have the most enjoyable and beneficial time possible at Imperial. As the GSU President, I want to emphasise that it is postgraduate students that Imperial is relying on to maintain its position as a Top 10 university in the world, therefore, your voices really do matter!

This year, our GSU Committee will keep improving postgraduate well-being by increasing the quality of supervision and by creating strategies to tackle mental health issues. Meanwhile, we will also try to strengthen the relationship with enterprises, so that we can co-organize more campus activities, negotiate job and internship opportunities for our postgraduate students and raise more money for our social and recreational events.

We also realised your learning, researching and job/internship application in this year might be terribly influenced by the COVID-19 pandemic. This might also be worrying you. To minimise the effects and guarantee that your voices are heard, my team and I will meet you through online or offline channels, collect your opinions and ideas, and advocate them to the university.

This GSU Committee is ready to serve for you. We are happy to answer your questions and fully expect to receive your feedback. I wish you all the best at Imperial. Please stay happy and healthy!

Zixiao Wang
President of Graduate Students’ Union
Imperial College London
Email: gsu.president@imperial.ac.uk
1. Introduction to the Department

Welcome from MSc Course Director

On behalf of all members of the academic and support staff I would like to welcome you to the MSc in Advanced Materials Science and Engineering. We hope you will enjoy your year with us and will benefit from the opportunities our programme offers.

By studying in the Department of Materials at Imperial College, you have become a member of the oldest and largest department of its kind in the UK. We are proud of our internationally leading research programmes in the synthesis, processing, and modelling of a broad range of materials (metals, ceramics, semiconductors, glasses, ceramic-matrix composites, polymers and functional materials). The research is applied to a wide range of contemporary problems: nuclear power, battery technology, aerospace engineering, biomedical innovations, automotive engineering, communications, electronics, and more. Please feel free to talk to the academics about their research. By carrying out a research project during your time here, you will be making your contribution to our shared success.

The MSc is a stand-alone qualification designed to:

1. Provide you the core skills needed to pursue research and development in materials and related areas.
2. Provide you up-to-date knowledge of major themes in materials.
3. Prepare you for a wide range of careers in materials.

We aim to achieve these goals by:

1. Teaching you about materials characterisation and modelling, offering research seminars for you to attend, and giving you a research project.
2. Allowing you to select a number of options, so you can decide what areas you wish to be knowledgeable in.
3. Providing you with transferrable skills courses and opportunities for industry engagement.

This handbook is designed to inform and help you: time taken now to have a read and familiarise yourselves with its contents will make life easier later. If you have a question about the course, please check the handbook: it should have the answer. Of course, if you think we have missed something, please let us know.

I wish you all the best during your time with us.

Prof Andrew Horsfield
Course Director
Academic and Administrative staff

- **Prof Andrew Horsfield**: MSc Course Director  
  Room: B331  
  +44 20 7594 6753  
  a.horsfield@imperial.ac.uk

- **Dr Fang Xie**: Deputy Course Director  
  Room: 103  
  +44 20 7594 9693  
  f.xie@imperial.ac.uk

- **Prof Alexandra Porter**: MSc Senior Tutor  
  Room: B341  
  +44 20 7594 9691  
  a.porter@imperial.ac.uk

- **Dr Ifan Stephens**: Projects Coordinator  
  Room: 2.03B  
  +44 (0)20 7594 9523  
  i.stephens@imperial.ac.uk

There are also a variety of other staff in charge of teaching who you might need to contact within the Department of Materials:

- **Prof Jason Riley**: Director of Undergraduate Studies (DUGS)
- **Dr Paul Franklyn**: Departmental Disabilities Officer/ Undergraduate Senior Tutor
The Student Office administrative staff will be your first point of contact for any learning enquiries and day to day queries:

**Mrs Raj Adcock**  
Teaching Operations Manager  
Oversees all administration of undergraduate (BEng/MEng) and taught postgraduate (MSc) programmes.  
Room: G03A  
+44 20 7594 6728  
materialsstudentoffice@imperial.ac.uk

**Mr Marlon Curniffe**  
Senior Student Office Administrator  
Based in the Student Office, supports the efficient administration of all taught programmes in the Department of Materials. Responsible for:  
- Timetabling/Celcat Management  
- Options management (internal and external)  
- Exam organisation  
- Panopto Management  
Alongside other day-to-day administration including general student support.  
Room: G03A  
TBC  
materialsstudentoffice@imperial.ac.uk

**Miss Harpreet Rajbans**  
Student Office Administrator  
Based in the Student Office, supports the efficient administration of all taught programmes in the Department of Materials. Responsible for:  
- Coursework management  
- Blackboard Learn Management  
- Work Placements/UROPs  
- Student exchange programmes (including Erasmus)  
- Student laptop loan scheme  
Alongside other day-to-day administration including general student support.  
Room: G03A  
+44 20 7594 6768  
materialsstudentoffice@imperial.ac.uk

**Miss Karolina Pielacha**  
Interim Student Office Assistant  
Based in the Student Office, supports the efficient administration of all taught programmes in the Department of Materials. Responsible for:  
- Locker Management  
- Assist with attendance monitoring  
- Assist with admissions applications  
- Assist with exam organisation  
- Assist with Student laptop loan scheme  
Alongside other day-to-day administration including general student support.  
Room: G03A  
TBC  
materialsstudentoffice@imperial.ac.uk
Attendance and absence

The college has three terms: Autumn, Spring and Summer. You are expected to be available to attend activities in College during term time. Classes at Imperial College run between the hours of 9:00am and 6:00pm except on Wednesdays, when they finish at 12:00noon allowing students to take part in sports and other activities.

Note that the term dates only refer to the calendar of lectures and the taught element. Your research component will require you to attend College outside term after the Summer Term. You are expected to attend all lectures, tutorials and any practical classes; they are interdependent and together they form the basis for all the knowledge you will build on during your studies. In the Department of Materials, we attach great importance to attendance by our students at your level of study. Therefore, you must inform your Senior Postgraduate Tutor 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 are ill and miss an assessment deadline (this could be an examination, presentation or a coursework submission) you will need to make a claim for mitigating circumstances within 10 working days of the deadline. Please see the section on mitigation below.

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/Student Route visas to the Home Office.

Key dates 2020–21

Term dates

Autumn term: 3 October 2020 - 18 December 2020
Spring term: 9 January 2021 - 26 March 2021
Summer term: 24 April 2021 - 25 June 2021

(Please note as MSc students your summer term ends at the end of September)

Closure dates

Christmas/New year: 24 December 2021 - 1 January 2021
(Easter Holiday: 1 April 2021 - 6 April 2021
(College reopens on 7 April 2021)

Early May Bank Holiday: 3 May 2021
Spring Bank Holiday: 31 May 2021
Summer Bank Holiday: 30 August 2021

Student Staff Committee dates

Tuesday 3rd November 2020 12pm-13:30pm
Tuesday 1st December 2020 12pm-13:30pm
Tuesday 26th January 2021 12pm-13:30pm
Tuesday 2nd March 2021 12pm-13:30pm
Tuesday 4th May 2021 12pm-13:30pm
Key events

Great Exhibition Road Festival: 3 - 4 July 2021

http://www.imperial.ac.uk/admin-services/secretariat/information-for-staff/college-year-card/

http://www.imperial.ac.uk/admin-services/registry/term-dates/
Provisional Examination Timetable

All dates and times are provisional and may change. No travel should be booked based on these times nor should other commitments be agreed to. Mitigation due to assumed dates from this timetable will not be accepted for problems attending examinations that are moved for any reason.

Due to COVID19 the information on the exams in spring/summer terms will be updated at the later stage.
2. Programme Information

The MSc is split into two main elements: taught and research. The taught element shares modules with the MEng in Materials Science and Engineering. There are three compulsory taught modules (characterisation, modelling and Art of Research), in addition to which you must take five optional modules, four of which are examined. It is possible that some students (those who have graduated with a BEng in Materials Science and Engineering from our Department) will already have taken one or two of the compulsory MEng modules: in this case these will be replaced by optional modules. The research element includes the research project plan and a research project (for which you need to write a thesis and give a presentation). Both of these are compulsory. The available modules are listed below, with the number of European Transfer Credits (ECTS) given in parentheses.

Note that if you select all 5 options from the nuclear strand and carry out a nuclear related project, you can transfer over to the programme "MSc in Advanced Materials Science and Engineering: Specialising in Nuclear Engineering"

The compulsory taught modules are:

(C1) MATE97001: Material Characterisation (6)
(C2) MATE97008: Materials Modelling (6)
(C3) MATE97044: The Art of Research (6)

The compulsory research related modules are:

(R1) MATE97045: Research Project Plan (8)
(R2) MATE97043: Research Project (40)

In addition to the core modules 5 optional courses must be taken from the following list (you will only be examined on 4 modules and will be asked to confirm the 4 options in Spring):

(O01) MATE97002: Engineering Alloys (6)
(O02) MATE97003: Ceramic and Glasses (6)
(O03) MATE97004: Polymers and Composites (6)
(O04) MATE97005: Electronic Structure and Optoelectronic Behaviour (6)
(O05) MATE97006: Nanomaterials I (6)
(O06) MATE97007: Biomaterials (6)
(O07) MATE97009: Surfaces and Interfaces (6)
(O08) MATE97011: Modelling Materials with Density-Functional Theory (6)
(O09) MATE97013: Advanced Engineering Alloys (6)
(O10) MATE97015: Advanced Thin Film Manufacturing Technologies (6)
(O11) MATE97017: Electroceramics (6)
(O12) MATE97019: Nanomaterials II (6)
(O13) MATE97021: Advanced Structural Ceramics (6)
(O14) MATE97023: Nuclear Materials (6)
(O15) MATE97025: Advanced Biomaterials (6)
(O16) MATE97027: Tissue Engineering (6)
(O17) MATE97050: Fusion and Advanced Reactors (6)
(O18) MECH97057: Nuclear thermal Hydraulics
(O19) MECH97058: Nuclear Reactor Physics
(O20) CENG97031: Nuclear Chemical Engineering (6)

As part of The Art of Research course you will attend research seminars (producing reports on three of them), an ethics course, and transferable skills seminars offered by the graduate school. You will meet regularly with your project supervisor in the autumn term to discuss your project
and to write your project proposal. A full-time independent research project will run from the end of the exam period beginning of September. Projects will be assessed by a final written report and oral presentation.

**ECTS summary**

Core modules = 18 ECTS  
4 x Assessed options = 24 ECTS  
Research Plan = 8 ECTS  
Research Project = 40 ECTS  
Total = 90 ECTS

**Thematic Strands**

To support coherent course choices that work together and promote learning of more specific aspects of materials the course options are grouped into themes, as outlined below:

**Compulsory courses**

These courses must be studied by all students regardless of the strand or combination of courses they select.

Art of Research
Research Project Plan
Research Project
MATE97001: Materials Characterisation
MATE97008: Materials Modelling

Ceramics and Glasses
MATE97003: Ceramics and Glasses
MATE97017: Electroceramics

Metals
MATE97002: Engineering Alloys
MATE97013: Advanced Engineering Alloys

Polymers and Composites
MATE97004: Polymers and Composites
MATE97021: Advanced Structural Ceramics

Functional Materials
MATE97005: Electronic Structures and Opto-Electronic Properties
MATE97009: Surfaces and Interfaces
MATE97011: Modelling Materials with Density-Functional Theory

Nanotechnology
MATE97006: Nanomaterials
MATE97019: Nanomaterials II
MATE97015: Advanced Thin Film Manufacturing Technologies

Biomaterials Survey
MATE97007: Biomaterials
MATE97025: Advanced Biomaterials
MATE97027: Advanced Tissue Engineering

Nuclear
MATE97023: Nuclear Materials
MATE97050: Fusion and Advanced Reactors
MECH97057: Nuclear thermal Hydraulics *
MECH97058: Nuclear Reactor Physics *
CENG97031: Nuclear Chemical Engineering *

*These modules are run by other engineering department not materials

Students who have graduated (on the BEng) already from the Department of Materials are forbidden from repeating courses that they have previously completed.

**Study Groups**

Learning can be greatly enhanced by talking with your fellow students about ideas being taught, and problems being solved for coursework. We are thus assigning you to study groups with about 10 students each. They will be set up once you have selected your options, so that we can put people with similar interests in the same group. Each group will have a representative, chosen by the group, who will help coordinate group activity, and will be a link to the Department for that group.

The group team leader is responsible for set-up the Microsoft teams meeting for you to meet virtually (on the dates below), where you can discuss, catch-up on life over a coffee/tea etc.

**Term 1:**
Tuesday 27th October 2020
Tuesday 24th November

**Term 2:**
Tuesday 2nd February 2021
Tuesday 2nd March 2021

**Timetable**

You will be able to sign up to receive your own personalised timetable and you can find out more detail on how to set this up at [http://www.imperial.ac.uk/timetabling/](http://www.imperial.ac.uk/timetabling/).

**Preparing for the courses: reviewing background material**

The courses you take as part of your MSc may assume knowledge that you do not yet have. We provide three lectures covering two areas (crystallography and microstructure) as part of the Art of Research. In addition, we provide you material to fill any gaps in your existing knowledge. The assumed knowledge is what is taught by the Department during the first two years of the undergraduate programme.

We have organised much of the course material from our Years 1 and 2 into convenient learning packages that you can find on Blackboard (2020-2021 Materials General Information, MSc Advanced Materials and Engineering (J2U3T)). Each learning package has a description of the module, a set of notes, example problems, and an old exam paper so you can estimate the level of knowledge expected. Where available, recordings of the lectures have been made available through Panopto. The learning packs will be available throughout your time studying for the MSc: you can refer to them whenever this is needed.
To provide structure to your study, we provide a comprehensive paper taken by our undergraduates in Year 3 that covers material form across Years 1 and 2. While much of the study may be done alone, we strongly encourage meeting with your colleagues to discuss what you are doing: that way you can help each other learn.

**Topics covered in Year 1**
MSE 101 Maths and computing  
MSE 102 Materials Chemistry  
MSE 103 Mechanics  
MSE 104 Microstructure and Properties of Materials  
MSE 105 Materials Physics  
MSE 106 Materials Engineering [not available as not a prerequisite]

**Topics covered in Year 2**
MSE 201 Maths and computing  
MSE 202 Materials Chemistry  
MSE 203 Mechanical Behaviour  
MSE 204 Microstructure  
MSE 205 Electronic Properties of Materials  
MSE 206 Materials Engineering

**Research Project**
You will learn what your project will be in week 1 of the Autumn Term. You can start on the project plan immediately after you have spoken with your supervisor. The plan must be submitted for assessment by the end of the Autumn Term. The research is mostly carried out once you have finished your exams, after which you need to write it up as a thesis (submitted in early September), and present a talk about it to the other MSc students and some academics (end of September).

**Research Project Plan**
During the Autumn Term you will need to write a project proposal. This gives the information you need to plan the project in advance, and to enable the Department to assess the suitability of the project. Below is the format of the project proposal with a description of the information requested. Note that preparation of the proposal will require reading and understanding of the literature, as well as an appreciation of what the project will aim to achieve. Please refer to the deadline planner for the exact deadline date on page 25.

**Track Record [No marks]**
One paragraph describing what your UG degree covered.
- Note any previous research work you have done
- Note any experimental equipment you have learned to use
- Note any computational methods you have learned to use

**Project Summary [85 marks] [approx. 4 pages]**
Background [40]
- Introduce the project topic and explain its context
- Review the state of scientific understanding in the field
- Describe the gap in our knowledge that the work will address
Research hypothesis and objectives [20]
• Set out your research idea or hypothesis
• Identify the overall aims of the project

Programme and methodology [25]
• Describe your research methodology
• Describe the work programme, indicating what research is to be undertaken, and the order in which the work will be done

Research Impact [5 marks]
One paragraph to describe how your research may be of benefit to society and the state of scientific knowledge.

Work plan [5 marks]
Provide a diagrammatic work plan (Gantt chart).

Resources Needed [No marks]
List the resources you will require, and what equipment training you will need. Indicate what assistance you will require from other people. Indicate how you will use the £500 allocated to your project by the department. Please confirm this with your supervisor.

References [5 marks]
Provide a list of your references here; around 20 would be typical.
This project proposal can be up to six A4 sides, including references. The minimum allowed font size is 11pt, the minimum margin width is 1.5 cm, and the minimum line spacing is single spaced.

Some other things to remember when submitting:
• Electronic copy submitted through Blackboard Learn (for marking)
• Electronic copy submitted though Turnitin (plagiarism check)
• Style of font is Calibri or Arial (or similar)
• A4 size

For the references you can either use a numerical scheme:


or the Harvard scheme (recommended if you are not using reference management software):


Art of Research/Research Based Teaching (all year)

This module is compulsory and includes a minimum of three elements:

- Regular attendance at research seminars. You need to write summaries on 3 research seminars of your choice. The summary of a seminar should be one A4 page (approx. 500 words). It should give the general background and key conclusions of the talk, and also your personal perspective on the research presented. Please refer to the deadline planner for the exact deadline date on page 25. However, I suggest you do a summary as soon as you hear a talk that inspires you. You will start to receive emails about LCN seminars, there will be a lot of these throughout the year and other talks too. Be proactive about getting information on more specialised talks from our research groups when you are assigned a supervisor. The reports are marked and form the assessment for this module.

- Attendance at a course on Research Ethics, to be scheduled in term 2.

- Attendance at the compulsory course ‘Writing for Masters 2: Literature Review’ which is timetabled in the department in week 2. You complete this online. Please try to get this done in Term 1 (classes only run from October to June) and then you can use the skills you have learnt for your research and study.

Lab Equipment

We will provide opportunity for training on some shared equipment that you might need to use in the context of your research project. Please discuss with your research supervisor whether this training is required as they will need to formally approve your registration. This can be discussed during the project planning. We will not allow training if justification is not given.

Note that your access to the equipment is subject to availability so please make sure you plan your experiments carefully and be respectful of everybody's needs on the equipment. Think carefully whether the time on a highly specialised equipment is really required, or if you could get the answers another way, and prioritise your key samples. Please note that any misuse of equipment can lead to your access being revoked.

Lab-work

Please note that safety is our number one priority. If you need to use labs, make sure you use the facilities responsibly and abide by the College, departmental and local safety rules.

Failure to abide by the safety rules will be penalised and can have consequences for your degree classification or even result in expulsion from the course.

We want you to experience our excellent research environment to carry out your project but can only do so if the safety rules are followed. In particular, please note that access to the labs will only be provided following training and if you have demonstrated that you can work safely and responsibly. Access is left at the discretion of the Laboratory Operations Manager(s) and can be revoked at any time. You are also not allowed in the labs outside of College working hours, Monday-Friday, 8am-6pm and should not work on your own. This still leaves plenty of time for experiments especially as you will need time to plot and interpret your results, and to refresh your knowledge of the literature. Therefore, a healthy balance of lab-work (or simulations in the case of theory-based project), planning, analysis and writing up is key to a successful project.

You should therefore aim to finish your lab-work (or simulations) two weeks before the project submission deadline.
**Thesis (Research Project)**

The thesis should answer the research question and convey the ability to develop an appropriate methodology to solve the problems posed. A high level of scientific understanding is expected. This includes an awareness of the scope and limitations of the techniques used, an ability to present and interpret results, the discussion of the results in light of the wider literature, and an understanding of the wider implications of the findings.

The layout should be discussed with the supervisor, but the recommended general outline is as follows:

- **Abstract**
- **Introduction**: brief overview of the background, statement of the aims, overview of the thesis layout.
- **Literature review**: This must not be a copy of what you wrote for the project proposal, but rather a review of the literature relevant to the project; it will generally be rather more extensive than what was done for the proposal.
- **Experimental/Materials and methods**: brief overview of the techniques used, and methods adopted or developed. The information should be sufficient to allow the work to be reproduced by someone else.
- **Results and discussion**: impeccably plotted graphs and annotated figures with helpful captions are expected. The results should be thoroughly described, with a clear narrative justifying the methods adopted and linking the findings to the aims. Discussions should go beyond simple description and be supported by general and specialised scientific concepts and literature.
- **Conclusions and future work**: a summary of the results and their implications in the field, as well as suggestions for key future work.
- **References**: the style should be consistent.
- **Appendix**: This is optional and will not be marked.

Writing concisely is a skill that you should be developing throughout the degree. It is easier to write a high-quality short document than a long one, and this is easier to mark in a robust fashion. Therefore, the project report is limited to **40 pages of A4 in length** (excluding any appendices for the supervisor, etc). This includes the cover page and references.

A template (in LaTeX and MSWord) is provided on Blackboard Learn and should be respected – **11pt Arial/Calibri for the main text, with 1.5cm margins, single spaced. Pages should be numbered, with the cover page being page 1**.

Further guidance is provided in the templates provided and the marking rubrics on Blackboard Learn. **Some other things to remember when submitting your thesis:**

- Electronic copy submitted through Blackboard Learn (for marking)
- Electronic copy submitted through Turnitin (plagiarism check)
- Thesis Declaration (find this on Blackboard Learn)

Please refer to the deadline planner for the exact deadline date on page 25.
Research Project: Final Presentation

You will need to give a PowerPoint presentation that summarizes your research project. You have a total of 15 minutes: 12 minutes for the talk plus 3 minutes for questions. Your presentation should:

1. Introduce the aims of the project and situate it in the context of the research literature
2. Show the main results and findings
3. Discuss those results and present your conclusions.

You need to express yourself confidently when discussing the work and answering questions. The presentation should have a logical structure and high-quality slides, figures and graphs.

Please refer to the deadline planner for the exact deadline date on page 25.

The following links are reminder of what is expected from you and your supervisor during your project:

**What master’s students and their project supervisors might mutually expect from each other (MSc, MEd, MPH, MRes & PG Dip)** – this document is intended to facilitate conversations between project supervisors and their students to establish effective partnerships.

The document can be found in the [Effective Partnerships](#) section of the Graduate School’s Supervisors’ Guide website.

**Roles and responsibilities of the Master’s Main Project Supervisor** - this document is intended to help clarify expectations as well as giving definition to the role of project supervisor.

The document can be found on the [Roles & Responsibilities](#) page of Registry’s Quality Assurance & Enhancement website.

Please refer to them thought out your projects for reference.

**Effective communication in English**

Being able to communicate effectively in English is crucial if you want to be successful at Imperial College. The emphasis in examinations and tests is on testing your mastery of the subject. However, expect to be marked down if you are not able to express yourself fluently in English. This is especially the case later in the MSc when more substantial written work such as the research thesis is assessed.

If you feel you would benefit from further lessons, there is a [Centre for Academic English (CfAE)](#) at Imperial which offers: “Free, dedicated support to international MSc students in science, engineering and medicine. Our aim is to help you with your language needs for your academic studies and to help you understand the expectations of postgraduate work. We offer:

- One-to-one tutorials with a dedicated tutor to support you with your course work and provide regular feedback
- Courses and workshops targeting specific academic language and skills”

If you wish to register for General Classes, Pronunciation Classes or Writing a Literature Review classes, you should contact the CfAE office to enquire at [english@imperial.ac.uk](mailto:english@imperial.ac.uk) or visit:

Centre for Academic English
Imperial College London
Room 309, Level 3, Sherfield Building
Classes start in mid-October and run until the end of the spring term, with some also running in the summer. Registration starts towards the end of the first week of term and more information on all these classes is available on MSc part of the CfAE website: https://www.imperial.ac.uk/academic-english/current-students/master's/

Widening your skills base: learning other languages

There are many excellent language courses in the College and below is a brief outline. More can be learnt from a visit to the Centre for Languages, Culture and Communication which is based on the third floor of the Sherfield Building or from https://www.imperial.ac.uk/centre-for-languages-culture-and-communication.

Students who would like to study a language can do so in their spare time if they wish. It is always useful to acquire fluency in another language and they are well taught here. The Centre for Co-Curricular Studies is prepared to mark tests and exams in the normal way for 'non-credit' students so you could use the qualification on your CV if you wanted to. There is also a language laboratory where, once you have registered as a user, you may arrange to study in your spare time.

The Graduate School

The Imperial College Graduate School supports the learning experience of postgraduate studies on taught and research degrees. As soon as you begin your postgraduate studies at Imperial College you automatically become a member of the Graduate School. Membership means you become part of a wider community, broadening and enriching your academic experience. Their remit includes both quality assurance and the provision of the award-winning and internationally renowned programme of transferable skills training.

As part of the Graduate School, the Postgraduate Development Unit (PDU) ensures that the transferable skills programme is educationally relevant, develops new initiatives and ensures its quality and relevance. All activity undertaken by the PDU is underpinned by an educational research programme, specifically focused on the postgraduate student experience.

The Graduate School is also responsible for the regular review of Master's Level Courses and Research programmes, ensuring best practice across the College.

They also organise a number of special events throughout the year which are designed to bring all postgraduate students together in an informal setting and to foster interdisciplinary discussion – as an MSc student we encourage you to participate in such events and to make use of the many opportunities Graduate School membership offers.

Full information is at: https://www.imperial.ac.uk/study/pg/graduate-school/.

MasterClass Programme

Students on Master's level programmes are encouraged to develop transferable skills as an important part of their postgraduate education here at Imperial, and most Master's students will receive transferable skills training as an integral part of their Master's programme.

The Graduate School has developed a MasterClass programme specifically for Master's level students https://www.imperial.ac.uk/study/pg/graduate-school/students/masters/.

These sessions have been designed particularly to give you an introduction to each of the following topics:

• Academic Writing
• Developing your career through Networking
• Informational Posters - Layout & Design
• Interpersonal Skills
• Interview Skills
• Job search with a difference
• Negotiating Skills
• Note Taking and Efficient Reading
• Preparing and writing a literature review
• Research Skills and Reference Management
• Stress Management

**Imperial Mobile app**

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

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

**Welcome to Imperial app**

The College has a Welcome to Imperial app which contains important information about campus operations, aspects of student life, a schedule of welcome activities and information about life in halls. All new students should download this guide to ensure they have the most up to date information and event schedule for the start of term.

You can download the App from the Apple or Google App Stores.

**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)
Updating your contact information

Most times we will communicate with you using e-mail, but e-mail is not the perfect communication medium for all messages. It is therefore in your interest to keep us informed of alternative ways of contacting you.

If your phone number(s) and/or address change during the year, remember to update this information on your ‘My Imperial’ account as that is where we will look for your personal information.

Official documents

To avoid queues at the Student Hub (throughout the year), you can request certificates via the on-line system (http://www.imperial.ac.uk/student-hub/our-services/). Due to the extremely high volume of requests at registration time, they may take slightly longer. Student Records cannot respond to every e-mail received, so if you do not receive a reply, this does not mean that they did not receive your request.

The following documents can be requested through the on-line system:

- Standard Statement
- Letters for Banks
- Council Tax Certificates
- Police Letter/Statement with Address
- Transcript
- Degree Confirmation Letter

More detail about these letters can be found on the Student Hub page (http://www.imperial.ac.uk/student-hub/our-services/student-records/)

Reading and responding to e-mails from the College

Please make sure you read your e-mail messages at least three times a week. If you receive an e-mail asking you to contact the Student Office or one of the lecturers, you should respond in a timely manner.

Lockers

You will be allocated a locker for the duration of your degree which you can use to store your personal belongings and resources needed for your studies.

Please ensure you do not keep anything unsafe in your lockers and you abide by the points highlighted in the locker policy below.

Locker Policy

- Please only use the locker allocated to you.
- Secure your allocated locker with a padlock.
- Please ensure any items you may have borrowed from Academics, PhD students, or Technicians for your projects or lab work are returned to them before the deadline for lockers to be emptied.
- Lockers must be emptied by early September (MSc Students), dates to be confirmed. All personal items and rubbish must be disposed of, and anything left in lockers after the date given by the Student Office will be thrown away.
• Any items stored in lockers that have been taken from or created in labs must be returned, recycled, or disposed of appropriately when your clear out your locker.

*Please note due to COVID this may not be possible for Autumn Term.

Departmental laptops

**Short-Term Loan Pool Scheme:**
All taught students in the department are permitted to borrow a laptop from the short-term loan pool scheme if their own laptop requires repair. Loan pool laptops can be borrowed for a maximum of four weeks, and extensions cannot be provided for the scheduled date of return*. The short-term loan pool scheme policy can be found in the 2020-2021 Materials General Information folder on Blackboard Learn.

* Please note that the short-term laptop scheme will not be available during the 2020-21 autumn term. This will be reviewed later in the academic year and may become available later in the year.

3. Assessment

**Examination of Compulsory and Optional Courses**
The examination of the compulsory and optional taught courses is solely by written examination with the exception of MATE97001, MATE97002, MATE97011, MATE97015, and MATE97019 which consist of coursework and exam components. MATE97044 is assessed entirely by coursework and MATE97008 is assessed by coursework and a test.

**Project**
The project is assessed as follows:
- The research project plan contributes 8/48 (16.67%) of the overall mark
- A final presentation (in late September) accounts for 5/48 (10.42%) of the overall mark
- A written research report (submitted in early September) accounts for 35/48 (72.92%) of the overall mark.

The project supervisor will mark the project plan and a panel of assessors with mark the final report. In addition, supervisors are asked to add notes on the technical aspects of the project, the level of supervision required and any other factors that they feel should be made available to the external examiner. The report’s technical marks are calculated as the weighted average of the two marks (following moderation by the course director if needed).

The course consists of two elements:
- Lecture courses (42/90 (46.67%) of the total course mark), consisting of the components:
  1. Compulsory courses
  2. Optional courses
- Research Project (48/90 (53.33%) of the total course mark), consisting of the components:
  1. Research Project Plan
  2. Written Research Report
  3. Oral Final Presentation
Term breakdown

Term one:
- Materials characterisation lectures (MATE97001)
- Choose a project supervisor
- Research Project Plan (more detail on page 15)
- Art of Research (students attend a scientific seminar once a week – e.g. those offered by the Thomas Young Centre and the London Centre for Nanotechnology series).

Term Two:
- Materials modelling (MATE97008)
- Materials characterisation labs (MATE97001)
- Start of Research Project (more detail on page 15)

Term Three:
- Exams early in the term
- Continue with Research Project for the remainder of the term and carry on until mid-August. By the start of September, the students will have written a dissertation (more detail on page 18), and at the end of September will give a final oral presentation.

Coursework

You will be asked to write various pieces of coursework marked by your project supervisor or lecturer/demonstrator. All coursework is submitted electronically via Blackboard. All coursework must be submitted before the deadline. We recommend submitting 24 hours before the deadline in case there are problems. You should definitely leave at least one hour. For all reports the deadline for submission of your work is 3pm of the stipulated deadline date.

Blackboard will keep a record of the submission time of all work submitted electronically. Late receipt of work may be penalised. Where the deadline falls outside the term dates, it is replaced by the first Monday of the next term.

When submitting any coursework, please ensure you provide all of the information required on the front cover page (of your electronic documents):
- Full Name (registered name)
- CID Number
- Title subject of coursework you are submitting
- Course Programme

We can’t allocate you marks, if we don’t know who you are! So, it’s very important the above information is inputted on the front of any coursework submitted.

Late work

Work submitted up to one (1) day after the assessment deadline (date and time) will be marked but capped at the pass mark. Work submitted more than one (1) day late will not be accepted as a valid attempt and mark of zero will be recorded. However, the work may still be marked so you get your feedback.

<table>
<thead>
<tr>
<th>Days/Hours late</th>
<th>Penalty</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (up to 24 hours after the assessment deadline)</td>
<td>Capped at the pass mark</td>
</tr>
<tr>
<td>2 (more than 24 hours after the assessment deadline)</td>
<td>Mark of zero awarded</td>
</tr>
</tbody>
</table>
Coursework Deadline Planner

The table gives you important coursework dates that you should remember. Coursework should always be handed in by **3pm** via Blackboard Learn.

Please note that these dates are **preliminary and may change throughout the year**. The dates below also depend on what options you pick so you may not be doing everything listed below. You will be notified of changes by the Student Office by email.

<table>
<thead>
<tr>
<th>Term</th>
<th>Module</th>
<th>Assignment/Event</th>
<th>Due Date</th>
<th>Format</th>
<th>Feedback/Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Autumn</td>
<td>MATE97043</td>
<td>Choice of project title</td>
<td>11:00am 08/10/2020</td>
<td>Online selection</td>
<td>1 week*</td>
</tr>
<tr>
<td></td>
<td>Module options</td>
<td>Final module options</td>
<td>11:00am 13/10/2020</td>
<td>Online via MS forms</td>
<td></td>
</tr>
<tr>
<td></td>
<td>MATE97001</td>
<td>Equipment Demonstration Sessions</td>
<td>End of your lab session</td>
<td>Blackboard Learn Tests</td>
<td></td>
</tr>
<tr>
<td>MATE97001</td>
<td>XRD Classwork assignment</td>
<td>End of your classwork session</td>
<td>Electronically via Blackboard Learn</td>
<td>2 weeks (after all sessions have been held) *</td>
<td></td>
</tr>
<tr>
<td>MATE97011</td>
<td>Homework problem 1</td>
<td>15:00 26/10/2020</td>
<td>Electronically via Blackboard Learn</td>
<td>1 week</td>
<td></td>
</tr>
<tr>
<td>MATE97011</td>
<td>Homework problem 2</td>
<td>15:00 02/11/2020</td>
<td>Electronically via Blackboard Learn</td>
<td>1 week</td>
<td></td>
</tr>
<tr>
<td>MATE97011</td>
<td>Homework problem 3</td>
<td>15:00 09/11/2020</td>
<td>Electronically via Blackboard Learn</td>
<td>1 week</td>
<td></td>
</tr>
<tr>
<td>MATE97050</td>
<td>Coursework 1</td>
<td>15:00 10/11/2020</td>
<td>Electronically via Blackboard Learn</td>
<td>2 weeks*</td>
<td></td>
</tr>
<tr>
<td>MATE97011</td>
<td>Homework problem 4</td>
<td>15:00 16/11/2020</td>
<td>Electronically via</td>
<td>1 week</td>
<td></td>
</tr>
<tr>
<td>Module Code</td>
<td>Assignment Type</td>
<td>Due Date 1</td>
<td>Due Date 2</td>
<td>Delivery Method</td>
<td>Duration</td>
</tr>
<tr>
<td>-------------</td>
<td>-----------------</td>
<td>------------</td>
<td>------------</td>
<td>----------------</td>
<td>----------</td>
</tr>
<tr>
<td>MATE97011</td>
<td>Homework problem 5</td>
<td>15:00</td>
<td>23/11/2020</td>
<td>Electronically via Blackboard Learn</td>
<td>1 week</td>
</tr>
<tr>
<td>MATE97011</td>
<td>Homework problem 6</td>
<td>15:00</td>
<td>30/11/2020</td>
<td>Electronically via Blackboard Learn</td>
<td>1 week</td>
</tr>
<tr>
<td>MATE97011</td>
<td>Homework problem 7</td>
<td>15:00</td>
<td>07/12/2020</td>
<td>Electronically via Blackboard Learn</td>
<td>1 week</td>
</tr>
<tr>
<td>MATE97050</td>
<td>Coursework 2</td>
<td>15:00</td>
<td>24/11/2020</td>
<td>Electronically via Blackboard Learn</td>
<td>2 weeks*</td>
</tr>
<tr>
<td>MATE97050</td>
<td>Coursework 3</td>
<td>15:00</td>
<td>03/12/2020</td>
<td>Electronically via Blackboard Learn</td>
<td>2 weeks*</td>
</tr>
<tr>
<td>MATE97043</td>
<td>Research Project Plan</td>
<td>15:00</td>
<td>08/12/2020</td>
<td>Electronically via Blackboard Learn</td>
<td>After Christmas break</td>
</tr>
<tr>
<td>MATE97050</td>
<td>Coursework 4</td>
<td>15:00</td>
<td>15/12/2020</td>
<td>Electronically via Blackboard Learn</td>
<td>2 weeks*</td>
</tr>
<tr>
<td>MATE97011</td>
<td>Homework problem 8</td>
<td>15:00</td>
<td>14/12/2020</td>
<td>Electronically via Blackboard Learn</td>
<td>1 week</td>
</tr>
<tr>
<td>MATE97002</td>
<td>Engineering Alloys Coursework</td>
<td>15:00</td>
<td>17/12/2020</td>
<td>Electronically via Blackboard Learn</td>
<td>2 weeks*</td>
</tr>
<tr>
<td>MATE97015</td>
<td>Device manufacturing route report and workshops</td>
<td>15:00</td>
<td>11/01/2021</td>
<td>Electronically via Blackboard Learn</td>
<td>2 weeks</td>
</tr>
<tr>
<td>Code</td>
<td>Title</td>
<td>Due Date</td>
<td>Submission Method</td>
<td>Duration</td>
<td></td>
</tr>
<tr>
<td>--------------</td>
<td>----------------------------------------------------------------------</td>
<td>-------------------</td>
<td>-----------------------------------------</td>
<td>----------------</td>
<td></td>
</tr>
<tr>
<td>MATE97008</td>
<td>Modelling Problem set 1</td>
<td>08/02/2021</td>
<td>Electronically via Blackboard Learn</td>
<td>2 weeks*</td>
<td></td>
</tr>
<tr>
<td>MATE97009</td>
<td>Essay paper</td>
<td>15/02/2021</td>
<td>Individual submission electronically via Blackboard Learn</td>
<td>1 week (no marks, only feedback)</td>
<td></td>
</tr>
<tr>
<td>MATE97019</td>
<td>Nanomaterials Presentation abstract</td>
<td>16/02/2021</td>
<td>Electronically via Blackboard Learn</td>
<td>2 weeks</td>
<td></td>
</tr>
<tr>
<td>MATE97001</td>
<td>Characterisation Exercise Report Draft</td>
<td>Group A: 18/02/2021 Group B: 25/02/2021</td>
<td>Electronically via Blackboard Learn</td>
<td>2 weeks*</td>
<td></td>
</tr>
<tr>
<td>MATE97044</td>
<td>Art of Research</td>
<td>23/02/2021</td>
<td>Electronically via Blackboard Learn</td>
<td>2 weeks*</td>
<td></td>
</tr>
<tr>
<td>MATE97008</td>
<td>Modelling Problem set 2</td>
<td>01/03/2021</td>
<td>Electronically via Blackboard Learn</td>
<td>2 weeks*</td>
<td></td>
</tr>
<tr>
<td>MATE97009</td>
<td>&quot;Pecha-Kucha&quot; presentation slides</td>
<td>15/03/2021</td>
<td>Electronically via Blackboard Learn</td>
<td>2 weeks*</td>
<td></td>
</tr>
<tr>
<td>MATE97019</td>
<td>Nanomaterials presentation slides</td>
<td>16/03/2021</td>
<td>Electronically via Blackboard Learn</td>
<td>2 weeks*</td>
<td></td>
</tr>
<tr>
<td>MATE96002</td>
<td>Characterisation Exercise Report Final</td>
<td>Group A: 18/03/2021 Group B: 25/03/2021</td>
<td>Electronically via Blackboard Learn</td>
<td>4 weeks*</td>
<td></td>
</tr>
<tr>
<td>MATE97008</td>
<td>Modelling Problem set 3</td>
<td>23/03/2021</td>
<td>Electronically via</td>
<td>2 weeks*</td>
<td></td>
</tr>
<tr>
<td>Module Code</td>
<td>Module Title</td>
<td>Submission Date</td>
<td>Method of Assessment</td>
<td>Response Time</td>
<td></td>
</tr>
<tr>
<td>-------------</td>
<td>------------------------------------</td>
<td>-----------------------</td>
<td>------------------------------------</td>
<td>---------------</td>
<td></td>
</tr>
<tr>
<td>MATE97008</td>
<td>Modelling Research based assessment</td>
<td>26/04/2021</td>
<td>Electronically via Blackboard Learn</td>
<td>2 weeks*</td>
<td></td>
</tr>
<tr>
<td>MATE97043</td>
<td>Research Project Thesis</td>
<td>31/08/2021</td>
<td>Electronically via Blackboard Learn and Turnitin</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>MATE97043</td>
<td>Final Project Presentation</td>
<td>20th-22nd Sept</td>
<td>No submission</td>
<td>No marks provided, only oral feedback from the panel during the presentations.</td>
<td></td>
</tr>
</tbody>
</table>

**Marking**

Once the coursework has been marked and the mark recorded will be returned to you via Blackboard Learn by the Student Office. The letter grade mark scheme is set out below:

<table>
<thead>
<tr>
<th>Grade</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>A*</td>
<td>85%-100%</td>
</tr>
<tr>
<td>A</td>
<td>84-70%</td>
</tr>
<tr>
<td>B</td>
<td>69-60%</td>
</tr>
<tr>
<td>C</td>
<td>59-50%</td>
</tr>
<tr>
<td>D</td>
<td>49-40%</td>
</tr>
<tr>
<td>E</td>
<td>39-0%</td>
</tr>
</tbody>
</table>

Please note that not handing coursework in on time and a lack of quality in your work are considered as strong indicators of a lack of academic progression. Failure to complete coursework could seriously affect your chances of remaining on the course.

**Departmental policy of failures**

The Materials Department does not offer students the opportunity to repeat if you are deemed to have failed unless medical or personal problems are known to have had a severely adverse effect on their studies during the relevant academic year. Before the examination period all students are invited to provide the MSc Administrator with any relevant information concerning mitigating circumstances.

**Marginal module failures**

Students who fail modules by a small margin may be allowed to pass at the discretion of the exam board. No failures below 40%, however, can be considered.
Other module failures

Students who fail modules by a significant margin are required to withdraw from the College, but with the right to return to take the examinations for the failed modules again the following year in the summer, provided always that they have achieved a satisfactory mark in the research element (50% or more) but also enough marks for the taught element to be able get at least 50% after doing the re-sits.

Note that there are no re-sits for coursework. However, if any student cannot carry out practical work at a scheduled time or submit a report by a particular deadline because of a medical or personal problem, then alternative arrangements can be made if the MSc Administrator is informed. Given the above, in the absence of any accepted mitigating circumstances, the Materials Department does not offer students who have failed the research project element to either pass or repeat the year: they are required to withdraw from the College permanently.

Overall performance

In addition to these criteria, students also have to achieve a sufficiently high overall mark in both the taught and research elements for the year to pass. For any Masters course you must achieve at least 50% in each element of the MSc. Likewise, to achieve a Merit you must achieve 60% in each element and for a Distinction a mark of 70% for each element.

Instruction to Candidates for Examinations

Students who are candidates for examinations are asked to note that all examinations are conducted in accordance with the College Regulations. The relevant set of regulations will depend on your programme and year of entry, please see our Regulations webpage to determine which apply to you:

[www.imperial.ac.uk/about/governance/academic-governance/regulations/](http://www.imperial.ac.uk/about/governance/academic-governance/regulations/)

Instructions for exam candidates can be found here:


Academic Integrity and Academic Misconduct

As your programme of study continues, you will be taught the concept of academic integrity and how you can ensure that any work that you complete now, or in the future, conforms to these principles. This means that your work acknowledges the ideas and results of others, that it is conducted in an ethical way and that it is free from plagiarism.

Academic misconduct is the attempt to gain an academic advantage, whether intentionally or unintentionally, in any piece of assessment submitted to the College. This includes plagiarism, self-plagiarism, collusion, exam offences (cheating) or dishonest practice. Full details of the policy can be found at:


Definitions of the main forms of academic misconduct can be found below:
Plagiarism

You are reminded that all work submitted, as part of the requirements for an examination at Imperial College must be expressed in your own words and incorporate your own ideas and judgements.

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 may be intentional, by deliberately trying to use another person’s work by disguising it or not citing the source, or unintentional where citation and/or referencing is incorrect.

Plagiarism must be avoided, with particular care on coursework, essays, reports and projects written in your own time but also in open and closed book written examinations. You can support your understanding of proper referencing and citation by using the resources available from the College such as the Library learning support webpages at:

- www.imperial.ac.uk/admin-services/library/learning-support/plagiarism-awareness/

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.

TurnitinUK is an online text matching service which assists staff in detecting possible plagiarism. The system enables institutions and staff to compare students' work with a vast database of electronic sources. Your programme team will explain how it is used in your programme:

- www.imperial.ac.uk/admin-services/ict/self-service/teaching-learning/turnitin/

Link to the College’s mandatory online training for Plagiarism for Master’s students can be found here:

- www.imperial.ac.uk/study/pg/graduate-school/students/masters/professional-development/plagiarism-online/

This course was developed by the Graduate School, in conjunction with the Library. It aims to equip all Imperial postgraduate students with a working knowledge of the concept of plagiarism and how to avoid it.

You are required to achieve a threshold level of understanding which will be tested through a final exam. Instructions on how toa certificate as proof of completion can be found in the course in the section ‘Course Info.’

On completion of this online workshop you will be able to:

1. **Explain** what plagiarism is
2. **Identify** incorrect referencing and possible potential cases of plagiarism
3. **Apply** techniques to avoid the different types of plagiarism
4. **Reference** properly someone else's work as well as your own work
5. **Evaluate** and relate the impact of academic integrity to your own work as researcher and in your career

**If you do not find the course on your Blackboard, please follow the instructions self-enrol**
onto the course: Plagiarism Awareness (Masters Students) 2020-2021

Master’s programme administrators should decide the most appropriate time for their students to complete the course. Master’s students who progress to a doctorate at the College will not be expected to take the doctoral version of the course but will be reminded about the course 6 months prior to submission of their thesis.

Collusion

This is the term used for work that has been conducted by more than one individual, in contravention of the assessment brief. Where it is alleged that there has been collusion, all parties will be investigated under the Academic Misconduct procedure.

You should note that whilst the College encourages students to support each other in their studies you should be careful to ensure that you do not exceed any assessment brief with regards to individual work, acknowledge the contributions of others in your work, and do not leave yourself open to allegations that you have supplied answers to enable another student to commit academic misconduct.

Exam offences

Exam offences fall into two categories. These are offences that may be disruptive in the exam venue or are considered an attempt to cheat. This can include behaviour such as bringing unauthorised material into an exam, attempting to communicate with others apart from the invigilator, trying to remove examination material without permission, taking an exam for someone else or getting someone else to take an exam for you. It would also include having an electronic device that has not been fully turned off or failing to follow a reasonable instruction of the invigilators.

Dishonest practice

This is the most serious category under the procedure. Examples of dishonest practice include bribery, contact cheating (buying work from an essay mill or other individual to submit as your own), attempting to access exam papers before the exam, making a false claim for mitigating circumstances or providing fraudulent evidence, falsifying documentation or signatures in relation to assessment or a claim for mitigating circumstances.

Preparing yourself for the exam

Preparing for exams starts on the first day of the first term. The format of University exams is such that you are unlikely to achieve results which reflect your potential fully if you only start studying close to the exams. There is only limited time available for revision and you must make sure that you can use that time to re-visit the material to remind you of the understanding you have acquired during the year. You will need to do the following:

- Gather together, read, and understand all the lecture notes, classwork and worked solutions.
- Try past papers – papers for the last 2 years are available on Blackboard Learn (where possible).
- Know what is going to be covered in the exam and the format of the examination paper.
- Know when and where the exam will take place.
- If you are registered dyslexic, you should inform the Disability Officer (see page 46) as
soon after registration as possible. It is possible to receive certain concessions in examinations, e.g. extra time, use of a spellchecker, but this is only possible when a student has registered with the Disabilities Office

Just before the start of the exam

- Be in plenty of time for the exam, allowing for public transport etc. if necessary. You will be allowed into the exam room about ten minutes before the start of the exam. All personal belongings should be left at the front of the classroom.
- Be absolutely sure you have NO revision notes on your person when you take your seat. You risk disqualification if you forget this. There will be a seating plan with your candidate number on a desk in the exam room: find it and sit down in the appropriate seat. Do not look at the exam paper until you are told to do so by the administrator/invigilator.
- If you are too unwell to sit an exam you must consult a doctor on the day of the exam and obtain a letter from him/her stating that you were not well enough to sit an exam. It is essential that you inform the Student Office immediately and before the start of the exam.

Please note this may not apply this year due to COVID.

During the exam

- At the start of the exam there will be a number of members of staff present. You will be told when you can start the paper and when you must stop writing.
- Staff will act as invigilators and will supervise the exam and patrol the examination room from time to time. Several different members of staff may share the invigilation duties during the exam.
- Read the instructions for the exam carefully and make sure you are aware of what you are required to do. If any errors are found in the exam paper the invigilator will inform you and corrections will be written on the whiteboard at the front of the class.
- You may leave the exam permanently at any time from thirty minutes after the start of the exam. You may not leave the exam in the last thirty minutes of the allotted time as this may cause a disturbance to other candidates. Once you have left the exam room you will not be able to go back (but see below).
- On the front of every answer book write your candidate number clearly. Never write your name on your answer books.
- If you have a query or require extra answer books raise your hand and the invigilator will come to you. **NEVER leave your seat without permission.**
- You may leave the lecture theatre under supervision to use the toilet. Again, you should inform the invigilator by raising your hand and he/she will then escort you to the nearest toilet.
- If you have attempted more questions than is required, delete clearly the questions you do not wish to be marked. You should not hand in any rough work. On the front of the first answer booklet write the numbers of the questions that you have attempted.
- Do not leave your seat until you have been told that you may do so even after the exam has finished.

Please note this may not apply this year due to COVID.

Good examination technique

- Always read the exam questions carefully - it is time very well spent. It is amazing how often the candidate provides an answer, which is not what the question requires. The most common reason is that the candidate starts reading the question and finds it similar to a class work problem previously attempted. The candidate then skims quickly over the rest of the question and starts providing the answer for the class work problem with which
he/she is familiar, although the exam question requires a significantly different answer.

- Always attempt the full number of questions required. For example, if the exam requires you to answer three questions it is better to attempt three questions than to spend all your time attempting to answer two questions perfectly. This is because, in general, it is relatively easy to obtain the first 55-65% of the marks for a question but it becomes increasingly more difficult to obtain the remaining marks.
- The questions asked in an exam are straightforward - there are no tricks! Remember the questions are set so that a student should be able to gain full marks in the limited time available for each question in the exam. From the time available for each question you should be able to estimate the correct amount of time to spend on each part of that question. This in turn will guide you concerning the amount of detail expected in, for example, the answer to a descriptive part or a derivation.
- If you finish the questions in less than the time allocated, spend the remaining time checking your work. Check the arithmetic and, in the case of more qualitative questions, think about your lecture notes/lab class reports again - you might come up with more relevant facts, which escaped your memory during your first attempt at the question.
- If you make an error in the arithmetic/maths in your answer, don’t panic. You will lose a few marks for the error but most of the marks are given for the method.

After the exam

After the exam the exam scripts are marked by the examiners and then second marked by another member of staff. This process can take several weeks so you will not receive any feedback immediately. Exam results are not official until they have been considered by the External Examiners (a chosen academic from another university or suitably qualified person from a relevant industrial background) and there has been an examiners meeting (this takes place at the end of the course usually end of September). This is also true for coursework. After this has taken place you can download all your marks from your 'My Imperial' student account (exams and coursework).

In the unlikely event that you are unable to sit an exam through serious medical reasons you may be able to take the exam (if this is agreed by the exam board). Please note for MSc courses this is the following summer, you are not permitted to sit the exam any other time.

Re-sits

You may find out that you have to take some re-sits in order to pass the degree program. You will be notified either after the exam board at the end of June or the board at the end of September. Please note the Departmental Policy on re-sitting exams is that they are ONLY allowed to be taken in the Department we do not allow them to take place abroad. You have to re-sit your exams within two years of your study here; failure to do this will result in you being withdrawn from the course.

Re-sit Timetable

If you are required to re-sit the following summer, then please note the Exam timetable will not be published until Spring term and you will receive an email from the Student Office in March with details for the re-sits you are doing.

Marking Schemes for postgraduate taught programmes:

The pass mark for all postgraduate taught course modules is 50%. Students must pass all elements in order to be awarded a degree.
Satisfactory progression during the year

During the year the Course Director will receive information on your progress of completed course work or examination results at intervals throughout the year and will discuss these with you (if necessary). Students who are deemed not to progress satisfactorily can be excluded from examinations; a procedure of which any funding source would be kept informed. Ultimately, the student may be put on a six weeks’ notice, and if there is no improvement in performance this ultimately may result in withdrawal from the course.

4. Board of Examiners

Board of Examiners

Members of the Board of Examiners are members of the academic staff of the Department of Materials and those from other departments in College who are involved in teaching and assessment in the Department of Materials. This list can be determined from your academic timetable. Also see the Appendix B (page 111) for a list of all academic staff involved in teaching.

External Examiners

Prof Alessandro Mottura, Birmingham University

External examining acts as an essential part of the College’s quality assurance and enhancement process, serving to ensure that academic standards are maintained. The knowledgeable and independent views of external examiners are invaluable in certifying that the College’s awards are appropriate and comparable as well as highlighting good practice and potential areas of enhancement.

During your programme you may be invited to meet your external examiners to discuss how you have found the programme or for a type of assessment called a viva voce (verbal exam). It is not appropriate however, for you to seek to submit complaints or representations directly to external examiners or to seek to influence them other than by giving feedback in a meeting. Inappropriate communication towards an examiner would make you liable for disciplinary action.

A summary of External examiners reports from the previous academic year can be found here:

www.imperial.ac.uk/about/governance/academic-governance/academic-policy/external-examining/

5. 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:

South Kensington Campus
Department of Materials
Royal School of Mines
Exhibition Road
London, SW7 2AZ – UK
View a map of South Kensington Campus:

https://www.imperial.ac.uk/media/imperial-college/faculty-of-engineering/department-of-materials/internal/SouthKensingtonCampus.pdf

The Royal School of Mines is building number 12 on the map. The best entrance to the building is via Prince Consort Road.

Closest Tube Stations: South Kensington and Gloucester Road.

Use of Departmental and College Facilities

For private study, students are allowed to be in the Department between the hours of 8:00am - 6:00pm only. If you need access out outside of these hours, then you will have to request for permission and please note it is not normally given to students for safety reasons. You will need to use your swipe card to get in and out of the department outside the normal College hours, and will be asked to sign a book so that the security officer knows where you are in any emergency – if the fire brigade does not know you are in the building they will not come looking for you. Your swipe card is only effective at the RSM entrance and the Bessemer Building entrance. **No experimental work is allowed unless the student is accompanied by a qualified person to supervise.**

Please note this may not apply this year due to COVID.

Computing rooms

You have access to the student computing room (G.08) apart from the times when a class is being held there and can print your documents there. You should not misuse the departmental computers, nor use them to play games. Many students need the computers to complete coursework using software only available on these computers and selfish behaviour is not tolerated. You will find further computing facilities in the library. You can use lecture rooms as your study room when lectures/tutorials are not being given there but you must check with the Student Office first.

Departmental Common Rooms

You have access to two common rooms: G06 and G10. G06 is accessible to all Undergraduate and MSc Students. G10 is only accessible to MSc Student and 3/4th year undergraduate students. These rooms are for you to study in, in both groups and individually. You should not misuse the departmental rooms and be respectful of other students when using the room. This room is for Materials student **ONLY,** do not let in any other authorised students in the room. Any misbehaviour will **not be tolerated.**

Please note this may not apply this year due to COVID.

Photocopying and printing

Your swipe cards will have an amount of credit loaded on to it at the beginning of the term for use with the photocopiers in the computer rooms. You can use any printer/photocopier across the campus that is for student use with your swipe card. If you run out of credit then there is a top up machine in the central library. Please use the pre-loaded credit wisely as the department will not top it up for you.
Library Services

The Central Library at South Kensington is open around the clock for study space 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 300,000 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. In order to keep you safe many of our services are operating remotely and we will be controlling the numbers who can visit our libraries. Services may be slightly reduced but you can keep up to date with the latest developments on our website and on Twitter @imperiallibrary.

www.imperial.ac.uk/library

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 AccessAble access guides:

www.accessable.co.uk/organisations/imperial-college-london

Smoke-Free Policy

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

www.imperial.ac.uk/smoke-free

SafeZone

SafeZone is a College app through which you can quickly and directly contact the Security team whenever you need them. Whether you're in an emergency situation, in need of First Aid or want to report an incident on campus, SafeZone allows you to be immediately put in touch with a member of our Security team and, at the touch of a button, can share your location and personal profile so that they can respond quickly and effectively to your specific needs. It also allows the entire College community to stay informed in the event of a major incident in London or wherever you may be in the world. Safezone also
provides information on other services, such as real-time updates on the College shuttle bus.

SafeZone is optional to register for and is now available to download on the Apple and Android App stores. Visit www.imperial.ac.uk/campus-security for more details about SafeZone.

All existing phone numbers for the Security team are still operational. In the event of an emergency, you can still call 4444 from any internal College phone. In the event of a wider incident in London, you can now also call 0300 131 4444, Imperial’s Emergency Recorded Message Line, which will point you in the direction of up-to-date information and advice.

**Changes due to Coronavirus (COVID-19)**

The College will keep you informed about any further changes that may affect you due to the impact of coronavirus (COVID-19). The COVID-19 FAQs on the website are a repository of helpful information and the latest guidance can be found at:

https://www.imperial.ac.uk/about/covid-19/students/

6. **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 should 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/Student Route visa you can work, no 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 Personal/Senior Personal Postgraduate Tutor. If you are on a Tier 4/Student Route visa you should also seek advice from the International Student Support team regarding visa limitations on employment.

The College’s examination boards will not normally consider as mitigating circumstances any negative impact that part-time work during term-time may have had on your performance in examinations or in other assessed work. Examinations or vivas cannot be rescheduled to accommodate your part-time working arrangements.

7. **Health and Safety**

Keeping you safe is a top priority for us. We continue to be guided by the latest official government guidance. At Imperial, we also have some of the world’s leading researchers of the coronavirus (COVID-19) pandemic who are advising governments around the world on the most effective measures to take to protect people from the virus as well as developing and testing a new vaccine.

Government guidance will continue to change in the UK over the coming months and we are regularly updating our plans for your safe return to campus.
You can find the latest guidance on the measures we are taking for your safety, plus information about the healthcare support available to you at:

www.imperial.ac.uk/about/covid-19/students/keeping-you-safe/

**What measures to expect in the Autumn Term?**
Arrangements may change, but on current plans, as a minimum you can expect:

**Welcome pack**
On arrival at Imperial, you will receive a welcome pack that will include three washable cotton face coverings, hand sanitiser and anti-viral wipes.

**Good infection control**
The College is implementing good infection control procedures, for example, by frequently cleaning and disinfecting objects and surfaces that are touched regularly including door handles, light switches, furniture, handrails, IT equipment, desks, phones, flush plates, taps and dispensers. Perspex screens will also be used across the College in reception and service areas.

**Hand sanitisers and multi-surface cleaning wipes**
Around the College there will be hand sanitisers and multi-surface cleaning wipes for you to use, as well as plenty of hand-washing facilities.

**Social distancing**
You should keep at least two metres apart from other people. If you need to be in closer proximity, you should still stay more than one metre apart and it will be essential you adopt additional mitigating measures, such as wearing a face covering or a face visor, depending on where you are within campus. There will be clear signage systems and protocols to ensure you can go about your business while maintaining social distancing and good hygiene.

**Face coverings**
On campus, wearing a face covering is essential in most locations. Face coverings should cover both your mouth and nose.

<table>
<thead>
<tr>
<th>When it’s essential to wear a face covering:</th>
<th>When it’s not essential to wear a face covering:</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Walking around campus</td>
<td>- Library (when studying)</td>
</tr>
<tr>
<td>- Cafes and welfare spaces</td>
<td>- Offices</td>
</tr>
<tr>
<td>- Lecture theatres</td>
<td>- Laboratories</td>
</tr>
<tr>
<td>- Teaching rooms</td>
<td>- Workshops</td>
</tr>
<tr>
<td>- Library (in queues)</td>
<td></td>
</tr>
<tr>
<td>- Halls of residence</td>
<td></td>
</tr>
<tr>
<td>- Travelling on public transport</td>
<td></td>
</tr>
</tbody>
</table>

For laboratories and other high-risk areas please refer to the local risk assessments for exact requirements.
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 contact is:

- **Dr Peter Petrov**
  - Room: B333 (LCN Corridor)
  - +44 20 7594 8156 or +44 20 7595 0321
  - p.petrov@imperial.ac.uk

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](http://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.

Please familiarise yourself with the Departmental Safety Policy and important useful safety personnel in the department which you can find on our website:

https://www.imperial.ac.uk/materials/internal-/hsdom/

**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

**Security**

We have been asked by the College Security to point out to all students the importance of looking after your own property. It is an unfortunate fact that the petty theft rate is relatively high in all Universities and Colleges and while we do our best to ensure that it is kept to a minimum it is up to you to make sure that you are constantly vigilant.

- Do not leave bags unattended in corridors or anywhere else.
- Do not bring valuable objects into College without good reason: if you must, then keep them safe, preferably by keeping them with you.
- If you have access to rooms, which are normally kept locked, then do lock the door when you leave.

8. **College Policies and Procedures**

**Regulations for Students**

All registered students of the College are subject to the College Regulations. The relevant set of regulations will depend on your programme and year of entry, please see our Regulations webpage to determine which apply to you:

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

www.imperial.ac.uk/students/terms-and-conditions

**Academic Feedback Policy**

We are committed in providing you with timely and appropriate feedback on your academic progress and achievement, enabling you to reflect on your academic progress. During your study you will receive different methods of feedback according to assessment type, discipline,
level of study and your individual need. Further guidance on the Policy of Academic Feedback can be found on the Academic Governance website:

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

Please review each individual coursework item to see the specific feedback policy relating to that item. Please note that feedback can take multiple forms in the Department, from verbal interaction with a GTA through to formal written assessed commentary on a submitted paper. Any interaction with a GTA, lecturer, tutor or other member of staff related to a learning process, should therefore be considered as part of your feedback on coursework.

Please note that your examination scripts once completed are belong to the College under the GDPR legislation. This means that you do not have the right to view them. Please see the College GDPR webpages for further information at:


Provisional Marks Guidance

Provisional marks are agreed marks that have yet to be ratified by the Board of Examiners. These results are provisional and are subject to change by the Board of Examiners. The release of provisional marks is permitted except in certain circumstances. Further information can be found in the Guidelines for Issuing Provisional Marks to Students on Taught Programmes:


Late Submission Policy

You are responsible for ensuring that you submit your coursework assessments in the correct format and by the published deadline (date and time). Any piece of assessed work which is submitted beyond the published deadline (date and time) would be classed as a late submission and will incur a penalty (a cap at the pass mark, or it is classed as a fail). Further guidance on Late Submission of Assessments can be found on the Academic Governance website:

www.imperial.ac.uk/media/imperial-college/administration-and-support-services/registry/academic-governance/public/academic-policy/marking-and-moderation/Late-submission-Policy.pdf

If you submit late due to mitigating circumstances, you may be able to make a claim that means that the cap on your mark is lifted. Please see below and the policy document.

Mitigating Circumstances

During your studies you may be affected by sudden or unforeseen circumstances. You should always contact your personal tutor for advice and support. If this happens at the time of, or immediately preceding your assessments you may be able to make a claim for mitigating circumstances. If successful this claim enables the Board of Examiners when reviewing your
marks at the end of the year to have greater discretion with regards to offering repeat attempts (either capped or uncapped), a repeat year, or with your progression or final classification. Please note, the Board are not permitted to amend the marks that you were awarded, only to take your claim into account in making decisions.

All claims must be supported by independent evidence and submitted within 10 working days of the assessment deadline. Any claim made after this deadline is likely to be rejected unless there is a good reason (such as you were still unwell) until the point of submitting the claim. Details of the College’s Mitigating Circumstances procedure can be found under the Mitigating Circumstances tab on the page below:

[www.imperial.ac.uk/about/governance/academic-governance/academic-policy/exams-and-assessment/](www.imperial.ac.uk/about/governance/academic-governance/academic-policy/exams-and-assessment/)

Through the procedure you may also be able to request an extension to deadline to some forms of assessment. Wherever possible it is expected that this is used as it will enable to you complete your studies within the same College year (rather than over the summer holiday or in the next year).

Mitigation is submitted in the Department by completing the mitigating circumstances form directly at [Mitigation Submission - 2020/21 MS Form](Mitigation Submission - 2020/21 MS Form). The link to the Mitigation Submission MS Form can also be found in the General Information folder on Blackboard.

Mitigating panels will meet regularly through the year (at approximately 2-week intervals). You will normally be given written feedback regarding your mitigation after the panel has met, and you are expected to act on the feedback you receive appropriately. Outcomes of mitigation submissions will be provided back to you through MS forms.

Support for ongoing or long-term conditions, or for registered disabilities would not normally fall under the remit of mitigating circumstances and students should be supported through their studies with Additional Examination Arrangements. More details can be found at:

[www.imperial.ac.uk/disability-advisory-service/support/exams/](www.imperial.ac.uk/disability-advisory-service/support/exams/)

**Academic Misconduct Policy and Procedures**

As has been highlighted under the Academic Integrity section, it is important that you learn how to properly attribute and acknowledge the work, data and ideas of others. Any proven form of academic misconduct is subject to penalties as outlined in the College’s Misconduct Policy and Procedures.

[www.imperial.ac.uk/about/governance/academic-governance/academic-policy/exams-and-assessment/](www.imperial.ac.uk/about/governance/academic-governance/academic-policy/exams-and-assessment/)

**Unsatisfactory Progress**

Unfortunately, sometimes students struggle to make satisfactory progress in their study or their engagement with their studies falls below our expectations. The College has a process to identify and support students by reaffirming these expectations with an action plan. The full details of this process, and the appeals procedure relating to it can be found at:

[www.imperial.ac.uk/about/governance/academic-governance/academic-policy/complaints-appeals-and-discipline](www.imperial.ac.uk/about/governance/academic-governance/academic-policy/complaints-appeals-and-discipline)
Academic Appeals Procedure

We have rigorous regulations in place to ensure assessments are conducted with fairness and consistency, claims for mitigating circumstances have been considered reasonably and in line with the regulations of the College, and that the decisions of the Boards of Examiners maintain the integrity of our academic awards. In the event that you believe that you have grounds to appeal these decisions, we have laid out clear and consistent procedures through which appeals can be investigated and considered:

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

Arithmetic Marks Check (Examinations and year results)

If you consider that there may have been an error in the adding up of your marks, you may request an arithmetic mark check. Please note that this must be requested within 10 working days of the official notification of your results from the Results team in Registry. You may not request a mark check for a previous year of study.

Mark queries are submitted in the Department by accessing the form directly via this link here or by going to the General Information folder on Blackboard.

Marks Query Check (coursework and test marks)

If you consider that a coursework assignment you have submitted or a test you have sat may have been unfairly marked against the rubric published, you may be able to request a check on the marks you have been awarded.

Mark query checks are submitted in the Department by completing the Mark Query Check form directly at Mark Query Check (non exams 2020/21) MS Form. The link to the Mark Query Check (non-exams 2020/21) MS Form can also be found in the General Information folder on Blackboard.

Mark Query Checks will only be considered when submitted within 10 working days after receiving your test or coursework mark, and any requests after 10 working days will only be considered with mitigating circumstances.

Outcomes of Mark Query Check requests will be published to you through MS Forms within 15 workings days.

Student Complaints

The College strives to ensure that all students are well supported in their studies and receive a good experience of their programme and the wider College activities. If you feel that your experience has not lived up to these expectations the College has an agreed Students Complaints process through which your concern can be investigated and considered.

If you have any concerns about your experience at the College and have been unable to address these informally, you should contact Student Complaints who can provide advice about what is the appropriate way to seek to resolve this at:

student.complaints@imperial.ac.uk

www.imperial.ac.uk/about/governance/academic-governance/academic-policy/complaints-appeals-and-discipline
**Student Disciplinary Procedure**

The College has the right to investigate any allegation of misconduct against a student and may take disciplinary action where it decides, on the balance of probabilities, that a breach of discipline has been committed. The general principles of the Student Disciplinary Procedure are available on the College website:

[www.imperial.ac.uk/admin-services/secretariat/college-governance/charters/ordinances/students/](www.imperial.ac.uk/admin-services/secretariat/college-governance/charters/ordinances/students/)

**Intellectual Property Rights Policy**

For further guidance on the College’s Intellectual Property Rights Policy is available on the College website:

[www.imperial.ac.uk/research-and-innovation/research-office/ip/ip-policy/](www.imperial.ac.uk/research-and-innovation/research-office/ip/ip-policy/)

Further information about the Imperial Enterprise Lab can be found at:

[www.imperial.ac.uk/students/enterprising-students](www.imperial.ac.uk/students/enterprising-students)

**Use of IT Facilities**

View the Conditions of Use of IT Facilities:

[www.imperial.ac.uk/admin-services/ict/self-service/computers-printing/staff-computers/conditions-of-use-for-it-facilities/](www.imperial.ac.uk/admin-services/ict/self-service/computers-printing/staff-computers/conditions-of-use-for-it-facilities/)

**General Data Protection Regulation (GDPR)**

All staff and students who work with personal data are responsible for complying with GDPR. The College will provide support and guidance, but you do have a personal responsibility to comply.

In line with the above please see the College’s privacy notice for students which form part of the terms and conditions of registration with the College.


**9. Wellbeing, Support and Advice**

**In your department**

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 at Imperial.

As a postgraduate university student, you are deemed to be an adult capable of making your own decisions. The downside of this is that you are also responsible for your own decisions and that you will have to suffer the consequences for any poor choices you make. Promising that you will work much harder next time round or pleading that you are a better student than the exam results show will not influence any decision by the Board of Examiners.
However, part of being a mature student is recognising that sometimes you need help or advice.

To help you make that transition towards being able to manage your own life a range of people are available for you to seek help or advice from.

The reason for seeking help sooner rather than later is quite simple: evidence of circumstances which have affected your performance are considered when making decisions about your progression. But with so many students with difficulties in their life who have gone before you and have performed exceptionally despite their difficulties, it is rare for a case to be strong enough to alter the decision.

You should therefore assume that as a rule, whatever your circumstances, once a test or exam has been taken, the result will stand. Before the test or examination, we can advise you what the regulations allow us to do for you or where you can find the most effective help.

Nobody can monitor how well you are doing better than you. If you are worried, seek help immediately.

Your MSc Senior Tutor

Your Senior Tutor acts as your personal tutor (if required) and will remain the same person throughout your time here at the Department. They would be the first point of contact if you need help or guidance alongside the Student Office.

Your Senior Tutor will therefore get to know you better than most other members of staff and is best placed to advise you on study skills, progression, and professional development. You can talk to your Senior Tutor in confidence on any matter that is affecting you. Your Senior Tutor can speak on your behalf at the meeting of the Examiners should that be required but can only act on information you have made available.

Your Course Director/Deputy Course Director

You Course Director/Deputy Course Director also acts as your personal tutor if the Senior Tutor is not available (if required). They can be contacted about course matters that you think need to be raised and addressed.

Your Course Director is also well placed to advise you on study skills, progression, and professional development. You can talk to your Course Director in confidence on any matter that is affecting you. Your Course Director can speak on your behalf at the meeting of the Examiners should that be required but can only act on information you have made available.

In addition of this you will also have two Class Representatives who you can raise any concerns on your behalf to both Senior Tutor/Course Director (more information on page 47).

The Materials Student Office team Emails: queries etc.

Please note that when emailing the Student Office, we aim to respond to your queries in a timely manner (within in 3 working days). However, this is not always possible in busy periods of the term so it can take longer, please keep this in mind. Do not resend emails or come into the office to ask us to respond to your email. We will always try our best to respond to urgent queries as soon as possible and other email when we can.

Letter request

If you need the Student Office to provide you with a letter, please give the us at least a week’s notice (more if possible). At busy times in the term it can take up to 2 weeks for a request like this to be done. So, ensure you keep this in mind and ensure you provide all the information you need in the letter by email.
If you require a reference Letter or a signature from the Course Director, please could you email and discuss this in advance of your need with them directly.

**Student Office Hours**

The Student Office is in G.03a and is open to students from:
- Monday 8:45am-4:15pm
- Tuesday 8:45am-4:15pm
- Wednesday 8:45am-2:00pm
- Thursday 8:45am-4:15pm
- Friday 8:45am-4:15pm

There will almost always be someone there to help you if you need it However, there may be times when the office is not open during the term due to staff meetings etc. so please keep this in mind.

**Due to COVID the Student Office team will be working remotely for Autumn term (if any changes occur you will be informed by email)**

**Departmental Disability Officers**

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

Your Departmental Disability Officer: Dr Paul Franklyn

Email: p.franklyn@imperial.ac.uk

Telephone: 44 (0)20 7594 6725

More information on Departmental Disability Officers is available at:

- [www.imperial.ac.uk/disability-advisory-service/support/ddos](http://www.imperial.ac.uk/disability-advisory-service/support/ddos)

More information about how to request additional arrangements for exams if you have a disability is available at:


**Your Union**

All Imperial students automatically become members of Imperial College Union when they register at the College. The Union provides a range of independent support.

**Imperial College Union Advice Centre**

The Union’s advisers are 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.
Imperial College Union operates two Representation Networks of over 600 elected student representatives – the Academic Representation Network and the Wellbeing Representation Network. Reps represent the voice of students and can direct you to internal and external support services. The Union’s Liberation Officers also work to make sure that the views of under-represented and interest groups are heard at the College.

If you have any feedback about issues in your department relating to academic or wellbeing issues, you can speak to one of your student representatives.

**Student Hub**

At the Student Hub, you can access advice about accommodation, admissions and financial support and get help with international student enquiries, questions about student records, and exams.

**Student Support Zone**

If you have moved home to take up your place at Imperial you will need to register with a new doctor (also known as a General Practitioner or GP) so that you can access NHS healthcare. It’s important that you register with a doctor soon after you arrive – don’t wait until you are sick, as this could delay your access to treatment.

Student Support Zone has lots of information about the resources available at Imperial and beyond to help you to stay healthy and happy. It’s a great place to start when you’re looking for some support – it covers advice about housing and money, health, wellbeing and maintaining a good work-life balance, and provides the details of who you can contact if you need some extra support.

**Useful support contacts**

**Registry**

[http://www.imperial.ac.uk/admin-services/registry/](http://www.imperial.ac.uk/admin-services/registry/)

**Health and wellbeing**

Imperial College Health Centre

40 Prince’s Gardens, South Kensington Campus  
020 7584 6301  
imperialcollege.hc@nhs.net  
www.imperialcollegehealthcentre.co.uk

Imperial College Dental Centre
Student Counselling and Mental Health Advice Service

020 7594 9637
counselling@imperial.ac.uk
www.imperial.ac.uk/counselling

Multi-Faith Chaplaincy Service

Chemistry Building, South Kensington Campus
chaplaincy@imperial.ac.uk
www.imperial.ac.uk/chaplaincy

Disability Advisory Service

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

International students’ support

Centre for Academic English

Level 3, Sherfield Building, South Kensington Campus
english@imperial.ac.uk
www.imperial.ac.uk/academic-english

International Student Support team

020 7594 8040
www.imperial.ac.uk/study/international-students

Accommodation

http://www.imperial.ac.uk/study/campus-life/accommodation/

Student Finance

http://www.imperial.ac.uk/fees-and-funding/

Careers

Careers Service

Level 5, Sherfield Building, South Kensington Campus
020 7594 8024
10. 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 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.

The Student Records and Data Team 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.
11. Work-life Balance

The pace and intensity of study at Imperial can be demanding so it’s important to find time for outside interests.

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.

Imperial College Union

www.imperialcollegeunion.org/about-us

Move Imperial

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

Whilst we are closely monitoring government advice, we are also beholden to the overarching College strategy of a phased return to campus and a reduction in on-campus activity until at least the beginning of the 2020-21 academic year. In line with this, we are anticipating being able to begin to reopen some of our facilities from Monday 7 September; details will be communicated regularly to our community.

More information about Imperial student memberships and updates to our services can be found at:

www.imperial.ac.uk/ethos/memberships/students

With an annual fee of £30 you will get use of the gym and swimming facilities on our campuses.

www.imperial.ac.uk/sport

We have a huge collection of online resources, home workout videos, healthy recipes and playlists available to all as part of our MoveFromHome campaign, more information can be found at:
12. 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 website.

We have two representatives for this MSc programme, who will also be invited to a meeting once every two weeks in term time with the key staff members who are involved in the organising of the MSc to address any matters of concern. This is in addition to the Staff-student Committee.

Staff-Student Committee

Staff-Student Committees are 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

13. Student Surveys

You should not be afraid to ask questions about the lectures or indeed to suggest ways in which the lectures could work better for you. However, keep in mind that what would be optimal for you might not be for your fellow students and that each lecturer will try to find a balance for the class which also suits their style of teaching.

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 Student Online Evaluation (SOLE) module/lecturer survey or departmental equivalent
- Postgraduate Taught Experience Survey (PTES)
- Student Experience Survey (SES)
The PG SOLE module/lecturer survey (or equivalent for your department) 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. 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 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.

The Student Experience Survey (SES) is an opportunity to give your views on your experience beyond the lecture theatres or labs. This survey will cover a range of College services and on the Imperial College Union.

All these surveys are confidential 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:

[link to website]

The Union’s response to surveys can be found here:

[link to website]

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

[link to website]

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

[link to email]

14. 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 Wi-Fi, complimentary 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

15. Appendices

Appendix A – Indicative Module Content

Unless otherwise stated the pass mark for each module is 50% for MSc Advanced Students

(C1) MATE97001 Materials Characterisation

<table>
<thead>
<tr>
<th>Module Leader:</th>
<th>Prof. Stephen Skinner</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teaching Staff:</td>
<td>Dr Sarah Fearn</td>
</tr>
<tr>
<td></td>
<td>TBC</td>
</tr>
<tr>
<td></td>
<td>Mr Richard Sweeney</td>
</tr>
<tr>
<td></td>
<td>Prof. Alexandra Porter</td>
</tr>
<tr>
<td></td>
<td>Dr Jonathan Rackham</td>
</tr>
</tbody>
</table>

Why study this module?
This course is designed to give students a firm foundation in the fundamentals of Materials Characterisation that will be required in subsequent years of study, in particular in their long research project.

The mission of Materials Characterisation is to explain the use of advanced techniques for the study of structure-property relationships in materials. The course content takes into account the exposure of the students to characterisation methods in years 1 and 2.

Learning Outcomes of this Module:

**Diffraction**

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

- Explain what X-rays are and describe their importance in structure determination.
- Discuss the components contributing to the formation of a diffraction pattern.
- Define and fully explain Bragg’s Law, the Laue equations, reflecting sphere construction and a reciprocal lattice.
• Discuss the experimental challenges of obtaining a useful diffraction pattern.
• Understand the importance of diffraction maxima for structure determination.
• Fully explain the atomic structure factor in terms of X-ray scattering.
• Explain the origin of systematic absences.
• Index powder diffraction patterns for cubic systems.
• Describe the similarities and differences between neutron and electron diffraction compared with X-ray diffraction.
• Demonstrate an understanding of the use of Le Bail and Rietveld analysis techniques for diffraction analysis.

**Ion Beam Characterisation**

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

• Understand and discuss fundamental ion-solid interactions for a range incident ion energies, and ion beam types i.e. mono-atomic and cluster ion beams. This topic includes the modelling program, SRIM.
• Understand ion beam interactions on materials, and how the sputtered material is used in different techniques e.g. secondary ion mass spectrometry (SIMS) and low energy ion scattering (LEIS).
• Understand and discuss the difference between these two techniques and origin of the measured species.
• Understand the concept of, and calculate ion beam dose, and discuss how this influences ion beam analyses: static and dynamic SIMS.
• Understand the important effects such as oxygen and caesium surface coverage on the efficiency of positive and negative secondary ion formation, respectively.
• Understand the basic SIMS equation and the importance of sputter yield and ionisation efficiency.
• Understand the concept of mass and depth resolution, and how they are influenced by experimental conditions.
• Discuss the application of SIMS to surface analysis and its modes of operation including mass spectra, surface imaging and concentration depth profiling.
• Understand the difference between time-of-flight, magnetic sector and quadrupole mass filters.
• Understand the importance of vacuum levels in the instrumentation for high level detection analyses.
• Understand the characteristics of primary ion sources such as liquid metal ion sources, and electron ionisation sources, and plasma sources.
• Discuss characteristics of primary ion sources such as their brightness.
• Understand the origin of channelling contrast obtained with highly collimated ion beams.
• Understand and discuss the application and use of Ion beam instruments in surface analyses and materials characterisations.

**Electron Microscopy**

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

• Explain wave-particle duality and discuss the wave properties of electrons.
• Discuss the concept of resolution.
• Describe the design and operation of scanning electron microscopes (SEM) and transmission electron microscopes (TEM), with particular reference to electron sources, electrostatic lenses and electromagnetic lenses.
• Describe specimen preparation techniques for SEM.
• Describe the specimen preparation for TEM.
• Discuss the types of aberration that can arise and current practical resolution limits for SEM and TEM.
• Discuss contrast mechanisms in SEM.
• Describe and explain secondary electron imaging and backscattered electron imaging in SEM.
• Discuss contrast mechanisms in TEM.
• Describe and explain bright-field imaging, dark-field imaging and diffraction pattern formation in TEM.
• Discuss the theory and use of energy dispersive X-ray analysis and electron energy loss spectroscopy.
• Discuss the scanning transmission electron microscope and the use of high-angle annular detectors for imaging.

Scanning Probe Microscopies (TBC once course tutor is defined)

On successfully completing this course, students will be able to:
• Explain what scanning probe microscopy is.
• Discuss the lateral imaging range and sensitivity to structure and properties.
• Specifically describe the theory, use and operation of the scanning tunnelling microscope and atomic force microscope including strengths and weaknesses of each technique.
• Discuss applications of scanning probe microscopies to materials characterisation.

Thermal analysis

On successfully completing this course, students will be able to:
• Describe the different types of thermal analysis techniques.
• Describe the limitations and challenges of the various techniques.
• Be able to select the most appropriate thermal analysis technique for a variety of characterisation investigations.
• Interpret thermal analysis data for simple materials.

How will I be Taught?

• 25 lectures: Autumn term (during week 2 and 3 of the Autumn term)
• 4 workshops
• 4 introductory laboratory sessions
• An open-ended characterisation exercise will take place in the Spring term, leading to a report due at the end of the Spring term.

How will I be Assessed?

Examination

The course is examined in the summer term. The examination paper, duration 2.5 hours, has 8 questions and is comprised of a mixture of short questions plus a long question that is based on analysing a series of experimental results and writing a reasoned interpretation of these data (50%).

Coursework

Students are expected to submit a report (35%) and complete a peer review activity (2%) related to the open-ended characterisation exercise, complete a workshop (5%) and attend a number of practical sessions (8%).

Assignment coursework forms will be uploaded in the relevant Blackboard Learn folder. The pass mark for the MSc Advanced Materials programme is 50%.
Reading List:

Required Reading


Recommended Reading

- Structure from Diffraction Methods, D.W. Bruce, D. O’Hare and R.I. Walton, Wiley (2014)

Background Reading


MATE97001 Materials Characterisation – Characterisation Exercise Report Coursework Information

<table>
<thead>
<tr>
<th>Module:</th>
<th>MATE97001 - Materials Characterisation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assessment/Coursework Name</td>
<td>Characterisation Exercise Report</td>
</tr>
<tr>
<td>Academic in charge</td>
<td>Dr Jonathan Rackham</td>
</tr>
<tr>
<td>Method of submission</td>
<td>Blackboard Learn only</td>
</tr>
<tr>
<td>Student’s self-study hours: e.g. 10-15 hours of self-study required</td>
<td>25 hrs</td>
</tr>
</tbody>
</table>

Assignment details:

The cohort will be split into two halves, with one half starting their exercise a week before the other. Deadlines for each half are set accordingly.

Each half is further broken down so that students work in groups of four to characterise a pair of related samples with unknown identities. The identities of the samples, and the relationship between them, should be determined and the findings presented as a report written and submitted individually.

The following characterisation techniques will be made available to the groups in a free-form style, with support from GTAs. Some of
these may be conducted in person if procedures allow, otherwise GTAs will assist.

- Scanning electron microscopy (including energy dispersive X-ray spectroscopy)
- X-ray diffraction
- Atomic force microscopy
- FTIR spectroscopy
- Densimetry

In addition to these techniques, transmission electron micrographs will be available where relevant.

Students will receive feedback from a number of sources,

- verbally from GTAs during their time using equipment,
- verbally from academic staff during the office hours,
- in written form on their report draft.

Other requirements (if applicable):

The report should be written in the style of a short paper with a focus on presentation of results and discussion. A short introduction may be included but an extended introduction is not required.

A document template is provided (MS Word and LaTeX) and must be used. Report to be submitted as a PDF, maximum 6 pages in length.

**MATE97001 Materials Characterisation – Characterisation Exercise Report Rubric:**

<table>
<thead>
<tr>
<th>Item name/number</th>
<th>Value</th>
<th>Description of marking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abstract</td>
<td>10%</td>
<td>Provides context, a concise description of the experiments performed and the conclusions drawn. Makes reference to relevant numerical results. Would inspire further reading of the report.</td>
</tr>
<tr>
<td>Expt Details</td>
<td>15%</td>
<td>Appropriate techniques are mentioned and all key details are correctly provided in appropriate detail. All relevant analysis tools are described and referenced with an appropriate level of detail.</td>
</tr>
</tbody>
</table>
### Results 25%

All techniques used are appropriate with clear understanding of each technique. Primary analysis (e.g. indexing patterns, assigning spectra or taking dimensional measurements from micrographs) performed competently and completely. Results presented in a clear and engaging format with appropriate application of further processing (e.g. cropping, brightness/contrast correction, annotation). Successfully employs advanced composition techniques (e.g. stacking, insets, overlays, annotations and labels). Accompanying text appropriately describes all of the results presented with comprehensive comments made about reliability of individual results.

### Discussion 20%

Strong comparisons are made between results, presented as a well-developed narrative with extensive insightful abstract analysis performed competently and completely to support these comparisons. Regular and appropriate reference to literature.

### Further Work 5%

Several appropriate suggestions for further work are made, some are insightful. All are supported by relevant details (e.g. hypotheses to test, techniques to apply) and some reference to literature.

### Conclusions 10%

Concise conclusions with specific statement, summarising any insights drawn. Entirely supported by points made within the discussion.

### Written Presentation 5%

Journal-level presentation, ready to publish. Prose is well written and easy to read with clear structure and explanations. No/minimal grammatical/typographical errors. Figure captions give context and guide the reader to important features.

### References 5%

References are complete and all are appropriate. Bibliography is well formatted and unambiguous.

### Acting on Feedback 5%

Acted thoroughly on all points for improvement.

### MATE97001 Materials Characterisation – Equipment Demonstration Sessions Coursework Information

<table>
<thead>
<tr>
<th>Module:</th>
<th>MATE97001 - Materials Characterisation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assessment/Coursework Name</td>
<td>Equipment Demonstration Sessions</td>
</tr>
<tr>
<td>Academic in charge</td>
<td>Dr Jonathan Rackham</td>
</tr>
<tr>
<td>Method of submission</td>
<td>Blackboard Learn tests</td>
</tr>
<tr>
<td>Student’s self-study hours: e.g. 10-15 hours of self-study required</td>
<td>2</td>
</tr>
</tbody>
</table>
| Assignment details: | Students will attend four lab sessions in groups. Each session will introduce them to a different instrument(s):
1. Scanning electron microscope
2. Transmission electron microscope |
<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>3.</td>
<td>Atomic force microscope and thermal analysis (dilatometer and calorimeter)</td>
</tr>
<tr>
<td>4.</td>
<td>X-ray diffractometers</td>
</tr>
<tr>
<td>Students will be guided through each session by a worksheet with practical guidance provided by a GTA. The worksheet will pose various questions about the instrument and associated sample preparation.</td>
<td></td>
</tr>
<tr>
<td>Students will receive feedback during the session from the GTA and on their marked worksheets.</td>
<td></td>
</tr>
<tr>
<td>Other requirements (if applicable): e.g. Font size, style of font, word count etc. for inclusion in the handbooks</td>
<td>Any images submitted must show a scale bar and be annotated to highlight the relevant phenomenon.</td>
</tr>
</tbody>
</table>

### MATE97001 Materials Characterisation – XRD Class Work Assignment Coursework Information

<table>
<thead>
<tr>
<th>Module:</th>
<th>MATE97001 - Materials Characterisation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assessment/Coursework Name</td>
<td>XRD Class work assignment</td>
</tr>
<tr>
<td>Academic in charge</td>
<td>Richard Sweeney</td>
</tr>
<tr>
<td>Method of submission</td>
<td>Blackboard Learn</td>
</tr>
<tr>
<td>Student’s self-study hours: e.g. 10-15 hours of self-study required</td>
<td>1 hour of revision should be sufficient – a recap will be given during the lesson.</td>
</tr>
</tbody>
</table>

**Assignment details:**

This is a highly interactive session designed to re-inforce and enhance understanding of some of the concepts covered in the XRD lectures.

During this exercise the students will process some example data to determine the structure type, lattice parameter and composition of a brass specimen.

This will be achieved by following a step by step process explained in the booklet provided.

Staff and GTAs will be on hand to help and to answer any questions.

Tables, graphs and answers to questions must be entered into the booklet where indicated. The booklet must then be handed in before the end of the session through Blackboard Learn.
Other requirements (if applicable):

- All questions must be entered into the assignment booklet where indicated using the spaces provided.
- All tables must be completed with the correct values as instructed. Particular attention must be given to the use of the appropriate number of decimal places and significant figures.
- Graphs must include labelled axes with a suitable choice of range. All data points must be plotted clearly. The line of best fit biased towards low NRF values must be shown and the intercept should be indicated.
- Throughout, you should check that the values obtained seem sensible.
- Where an example procedure has been given, you must follow the same procedure.
- When calculating the composition, full working must be shown. The answer given must be within +/- 1% (absolute) of the correct answer. The sum of Cu and Zn must =100%
- For free text questions, you must give a logical, coherent account that fully addresses the question. (For the doublet question, it is insufficient to simply state that there are two wavelengths).
- The work should be presentable and legible throughout with clear and succinct answers.

Use the same information for the MSc offering of this module? Yes

---

**MATE97001 Materials Characterisation – XRD Class Work Assignment Rubric:**

<table>
<thead>
<tr>
<th>Item name/number</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data Table (p6)</td>
<td>1.5</td>
</tr>
<tr>
<td>Structure</td>
<td>1</td>
</tr>
<tr>
<td>Indexing</td>
<td>2</td>
</tr>
<tr>
<td>Structure Factor</td>
<td>3</td>
</tr>
</tbody>
</table>
Why study this module?

This course introduces students to a selection of important modelling techniques. It covers methods applicable to a range of length scales and materials types that can be used to solve practical problems in Materials Science and Engineering. Students will have an opportunity to use these methods by performing simulations using code that will be provided.

Learning outcomes:

- Introduction to computer simulation - Length and time scales
- Introduction to MATLAB
- Understanding Finite Elements and Crystal Plasticity
- Understand the algorithm for Metropolis Monte Carlo
- Apply Metropolis Monte Carlo to finding the equilibrium distribution of one or more particles
- Understand the diffusion equation and how to solve it using finite differences and Fourier Transforms
- Understand the merits of explicit and implicit solvers
- Apply kinetic Monte Carlo to solve the diffusion equation
- Understand the concept of a phase field
- Understand the relation of the free energy to the equation of motion of the phase field
- Understand the Cahn-Hilliard equation for spinodal decomposition
- Solve the Cahn-Hilliard equation for the spinodal decomposition of a binary alloy.
• Understand the concept of a potential energy surface in the context of aggregates of atoms
• Understand how the atoms’ real potential energy surface may be approximated to make atomistic calculations tractable.
• Understand the basics of how different types of bonding (ionic, covalent, metallic, van der Waals) are modelled.
• Understand what it means to find the minimum-energy structure of a molecule or crystal.
• Understand the molecular dynamics method for calculating finite temperature properties.
• Understand how to perform a Molecular Dynamics simulation (velocity Verlet) and a simple way to introduce the effect of a surrounding medium (Langevin dynamics).
• Understand a current research topic that employs computer simulation

How will I be Taught?
9 hrs lectures with 18 hrs of exercise classes: Spring term (a three hour session per week)

How will I be Assessed?
Assessment is through 3 problem sets, a research topic based assessment, and a 1 hour written test. The problem sets have equal weight and together are worth 60 marks, the research topic based assessment is worth 10 marks, and the test is worth 30 marks.
Assignment coursework forms will be uploaded in the relevant Blackboard Learn folder. The pass mark for the MSc Advanced Materials programme is 50%.

Reading List:

MATE97008 Materials Modelling – Modelling Problem Set 1
Coursework Information

<table>
<thead>
<tr>
<th>Module:</th>
<th>MATE97008 - Materials Modelling</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assessment/Coursework Name</td>
<td>Modelling Problem set 1</td>
</tr>
<tr>
<td>Academic in charge</td>
<td>Andrew Horsfield</td>
</tr>
<tr>
<td>Method of submission</td>
<td>Blackboard Learn only</td>
</tr>
<tr>
<td>Student’s self-study hours: e.g. 10-15 hours of self-study required</td>
<td>20 hours of self-study required</td>
</tr>
<tr>
<td>Assignment details:</td>
<td>There are two sets of problems to be done: one on finite elements and one on crystal elasticity.</td>
</tr>
</tbody>
</table>
Other requirements (if applicable): The answers are to be written onto the question sheets, and then scanned and uploaded to Blackboard.

**MATE97008 Materials Modelling – Modelling Problem Set 1 Rubric:**

<table>
<thead>
<tr>
<th>Item name/number</th>
<th>Value</th>
<th>Description of marking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Finite elements question</td>
<td>20</td>
<td>Small problems based on the finite elements lecture</td>
</tr>
<tr>
<td>Crystal elasticity question</td>
<td>20</td>
<td>Small problems based on the crystal elasticity lecture</td>
</tr>
</tbody>
</table>

**MATE97008 Materials Modelling – Problem Set 2 (Microscale Modelling) Coursework Information**

<table>
<thead>
<tr>
<th>Module:</th>
<th>MATE97008 - Materials Modelling</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assessment/Coursework Name</td>
<td>Problem set 2 (microscale modelling)</td>
</tr>
<tr>
<td>Academic in charge</td>
<td>Andrew Horsfield</td>
</tr>
<tr>
<td>Method of submission</td>
<td>Blackboard Learn only</td>
</tr>
<tr>
<td>Student’s self-study hours:</td>
<td></td>
</tr>
<tr>
<td>e.g. 10-15 hours of self-study required</td>
<td>20</td>
</tr>
<tr>
<td>Assignment details:</td>
<td>Answer questions and solve problems based on the lectures, class exercises and additional reading for Metropolis Monte Carlo, Diffusion and Phasefield.</td>
</tr>
<tr>
<td>Other requirements (if applicable):</td>
<td>Must fit in the space provided on the homework template. If handwritten, then must be scanned and saved as a PDF before submitting to Blackboard.</td>
</tr>
</tbody>
</table>

**MATE97008 Materials Modelling – Problem Set 2 (Microscale Modelling) Rubric:**

<table>
<thead>
<tr>
<th>Item name/number</th>
<th>Value</th>
<th>Description of marking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tabulated results</td>
<td>10</td>
<td>Values and explanation</td>
</tr>
<tr>
<td>Graphical results</td>
<td>5</td>
<td>Graph</td>
</tr>
</tbody>
</table>
MATE97008 Materials Modelling – Modelling Problem Set 3
Coursework Information

Module: MATE97008 - Materials Modelling
Assessment/Coursework Name: Modelling Problem set 3
Academic in charge: Dr Paul Tangney
Method of submission: Blackboard Learn only
Student’s self-study hours: e.g. 10-15 hours of self-study required: 20hrs

Assignment details:

Students will be provided with a MATLAB code and notes and instructions on how to use it. The code performs atomistic simulations (molecular dynamics and structural relaxation) of a simple polymer with or without an implicit solvent. Calculations will be performed and reported on.

Other requirements (if applicable):
The number of sentences accompanying each plot is restricted to one or two. Length restrictions on those sentences will be clarified in the assignment notes.

MATE97008 Materials Modelling – Modelling Problem Set 3 Rubric:

<table>
<thead>
<tr>
<th>Item name/number</th>
<th>Value</th>
<th>Description of marking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exercise 1</td>
<td>50</td>
<td>Present an image and an explanation</td>
</tr>
<tr>
<td>Exercise 2</td>
<td>50</td>
<td>Present an image and an explanation</td>
</tr>
</tbody>
</table>

MATE97008 Materials Modelling – Research Based Assessment
Coursework Information

Module: MATE97008 - Materials Modelling
Assessment/Coursework Name: Research based assessment
Academic in charge: Andrew Horsfield

Method of submission: Blackboard Learn only

Student’s self-study hours: 10

Assignment details: Answer questions about a current research paper whose contents are presented and explained in the lecture.

Other requirements (if applicable): No more than 5 pages. Minimum font size, 11pt.

**MATE97008 Materials Modelling – Research Based Assessment Rubric:**

<table>
<thead>
<tr>
<th>Item name/number</th>
<th>Value</th>
<th>Description of marking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Question 1</td>
<td>10</td>
<td>Compute values and comment on them</td>
</tr>
<tr>
<td>Question 2</td>
<td>10</td>
<td>Compute values and comment on them</td>
</tr>
<tr>
<td>Question 3</td>
<td>10</td>
<td>Compute values and comment on them</td>
</tr>
</tbody>
</table>

*(C3) MATE97044: The Art of Research Module Final*

Course Co-ordinator: Prof A Horsfield

Status: MSc Advanced MSE core course

**Prerequisites:** None

**Aim**

Provide students with background knowledge and transferable skills to support the MSc programme
Learning outcomes

Review of background material: crystallography (TBD)
At the end of the module you will be able to
- Interpret crystal structures in terms of their 2D and 3D lattices
- Apply the concepts of planes and directions in lattices to real materials
- Use the concept of packing sequences to explain crystal structures

Review of background material: defects and microstructure (TBD)
At the end of the module you will be able to
- Apply the concepts of stress and strain to deformable materials
- Explain how point defects influence the properties of materials
- Explain what a dislocation is and how it influences the plastic behaviour of materials
- Explain the fundamental properties of surfaces and interfaces
- Explain how phases and phase changes influence the formation of microstructure

Ethics course (External speaker)
At the end of the module you will be able to
- Apply the principles of ethical research to your own work

Writing for Masters 2: Literature Review (Graduate School)
At the end of the module you will be able to
- Write a properly organized literature review

One other course from the graduate school (Graduate School)
- Acquire a transferable skill

Research seminars (Various)
At the end of the module you will be able to
- Discuss current research and its merits
- Recognize a scientific talk that meets professional standards

Recommended textbooks A = required, B = recommended but not essential, C = background reading.

A  Materials Science and Engineering: An Introduction, Callister & Rethwisch (Wiley)

Structure, teaching and learning methods
2 lectures: Autumn term
Assessment
Three reports on the research seminars attended
The pass mark for the MSc course is 50%

Staffing

<table>
<thead>
<tr>
<th>Lectures</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Andrew Horsfield</td>
<td>1</td>
</tr>
<tr>
<td>Luc Vandeperre</td>
<td>1</td>
</tr>
</tbody>
</table>

Course Material

<table>
<thead>
<tr>
<th>Powerpoint Lectures</th>
<th>Lecture Handouts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Andrew Horsfield</td>
<td>1 1</td>
</tr>
<tr>
<td>Luc Vandeperre</td>
<td>1 1</td>
</tr>
</tbody>
</table>

MATE97044 The Art of Research – Art of Research Assignment

Coursework Information

<table>
<thead>
<tr>
<th>Module:</th>
<th>MATE97044 - Art of Research</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assessment/Coursework Name</td>
<td>Art of Research Assignment</td>
</tr>
<tr>
<td>Academic in charge</td>
<td>Andrew Horsfield</td>
</tr>
<tr>
<td>Method of submission</td>
<td>Blackboard Learn only</td>
</tr>
<tr>
<td>Student’s self-study hours: e.g. 10-15 hours of self-study required</td>
<td>20 hours (attending seminars and writing them up)</td>
</tr>
<tr>
<td>Assignment details:</td>
<td>You need to write summaries on 3 research seminars of your choice. Each summary should be one A4 page (approx. 500 words). It should give the general background and key conclusions of the talk, and also your personal perspective on the research presented.</td>
</tr>
<tr>
<td>Other requirements (if applicable):</td>
<td>An electronic copy should be submitted through Blackboard Learn for marking.</td>
</tr>
</tbody>
</table>
### (O01) MATE97002: Engineering Alloys

**Module Leader:** Ben Britton  
**Teaching Staff:** Minh-Son Pham, Chris Gourlay

#### Why study this module?

This course is titled Engineering Alloys 1: From Theory to Applications.

In this course, students will draw together key concepts within the “processing-microstructure-properties-performance” domain to consider the opportunities and challenges of using engineering alloys in real components. This course is focussed around key case studies to translate theory and understanding into real-world applications.

This course is well placed to lead into the 4th year module “Engineering Alloys 2: A Crystal Approach”

#### Learning outcomes:

- You will consider engineering with alloys, and multi-objective engineering design problems (cost, temperature, performance – e.g. creep, fatigue, strength, processability, light weighting, material costs & lifecycle).
• You will discuss approaches to engineering design and lifing, where failure and optimisation of alloys dominate function (drawing in ideas of process-microstructure-properties) in solid stage metal components.
• You will realise a deeper understanding of the science of alloys as a microstructure system with an engineering goal. This includes exploring microstructure mapping and crystallographic texture evolution in engineering alloys.

**How will I be Taught?**

27 contact hours (includes lectures, workshops and a computational exercise): Autumn Term (2 x two hour sessions per week)

**How will I be Assessed?**

*Examination (80%)*

The course is examined in the summer term in a single 2½ hour examination paper composed of five questions. Students answer 3 questions from the 5 available, each worth 20 marks giving a total of 60 for the paper. The balance of questions will broadly reflect the balance of lectures.

*Coursework (20%)*

Unit 6 includes a coursework based exercise, led during the lecture period. This includes development of understanding of crystallographic texture in engineering alloys.

The module contributes 100 marks towards the third year in both the BEng and MEng assessment schemes. The pass mark for the individual module on the BEng and the MEng courses is 40%.

**Reading List:**

- The Superalloys, RC Reed, CUP, 2007
- Titanium, Lütjering and Williams, Springer, 2003
- The Jet Engine, Rolls Royce
- Metals Speciality Handbooks in Nickel and Titanium, ASM Int’l (Donachie)
- Ashby, M.F. “Multi-objective optimization in material design and selection” Acta
Materilia (2000)
- Introduction to Texture Analysis and Orientation Mapping, Valerie Randle and Olaf Engler, VRC Press 2009

MATE97002 Engineering Alloys – Engineering Alloys Coursework Information

<table>
<thead>
<tr>
<th>Module:</th>
<th>MATE97002 - Engineering Alloys</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assessment/Coursework Name</td>
<td>Engineering Alloys Coursework</td>
</tr>
<tr>
<td>Academic in charge</td>
<td>Dr Ben Britton</td>
</tr>
<tr>
<td>Method of submission</td>
<td>Blackboard Learn only</td>
</tr>
<tr>
<td>Student’s self-study hours: e.g. 10-15 hours of self-study required</td>
<td>3 hours intro to Matlab works, 3 hours workshop for coursework exercise, 3 hours self study</td>
</tr>
</tbody>
</table>

Assignment details:

Students have been provided three example 'scripts' in Matlab that use MTEX to explore microstructures, orientation relationships and texture evolution using a Taylor model.

Students will modify the scripts, with added comments, and upload these to blackboard for assessment.

MATE97002 Engineering Alloys – Engineering Alloys Rubric:

<table>
<thead>
<tr>
<th>Item name/number</th>
<th>Value</th>
<th>Description of marking</th>
</tr>
</thead>
<tbody>
<tr>
<td>1: Burgers Orientation Relationship</td>
<td>5</td>
<td>Marks will be awarded for: correct solution (2 marks) Use of functions to determine the correct orientation (1 mark) Comments to show that you understood the challenge (1 mark) Marks will be awarded for commenting and annotation (1 mark) <em>Submit as a separate document</em></td>
</tr>
<tr>
<td>Q2: Grain Size Assessment and Texture</td>
<td>10</td>
<td>Plotting the grain size distribution &amp; evaluating a sensible metric to describe the distribution (2 marks) Plotting the segmented data &amp; extracting insight into the distributions (3 marks) Evaluation of the texture of the two regions and discussing it. (2 marks) Marks will be awarded for commenting and annotation (1 mark) Providing insight from two microstructural regions. (2 marks)</td>
</tr>
</tbody>
</table>
### (O02) MATE97003: Ceramics and Glasses

**Optional: For all BEng/MEng/MSc programmes**

<table>
<thead>
<tr>
<th>Module Leader:</th>
<th>Eduardo Saiz</th>
</tr>
</thead>
</table>
| Teaching Staff: | Finn Giuliani  
Norbert Klein |

**Why study this module?**

The overall aim of this course is to introduce students of the main methods and fundamental principles used for the processing of engineering ceramics (and, to a lesser degree, glass and glass ceramics) and develop an understanding of the factors that influence their mechanical properties. Furthermore, the course will give an introduction to microwave application of ceramics and discuss the electrodynamic response from dc to infrared frequencies and its correlation to the microstructure.

**Learning outcomes:**

- Describe the different types of particles (particles, agglomerates, granules, flocs, colloids, aggregates).
- Describe powder characterization methods. Interpret results from powder analysis (particle size, particle size distributions, specific surface areas).
- Understand the parameters that control powder packing and the dry pressing of ceramic powders.
- Explain the types of colloids and explain the different methods to stabilize colloidal suspensions (electrostatic stabilization, steric stabilization, electrosteric stabilization).
- Describe standard ceramic wet processing techniques and understand the key parameters in the formulation of ceramic slurries for processing.
- Describe the structure of glasses and their formation. Describe the structure of oxide glasses: silica, silicate glasses, borate glasses.
- Understand the figures of merit of microwave ceramics and their relevance for applications in wireless communication.
- Understand the dielectric resonator technique for measuring microwave properties of ceramics.
- Understand intrinsic and extrinsic mechanisms which lead to microwave losses in microwave ceramics.

**How will I be Taught?**

---

<table>
<thead>
<tr>
<th>Q3: Texture Evolution and the Taylor Model</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Updating the code to provide the desired texture (2 marks)</td>
<td></td>
</tr>
<tr>
<td>Comments on how/why you have modified the code to generate the updated texture (2 marks)</td>
<td></td>
</tr>
<tr>
<td>Marks will be awarded for commenting and annotation (1 mark)</td>
<td></td>
</tr>
<tr>
<td><em>Submit as a separate document</em></td>
<td></td>
</tr>
</tbody>
</table>
27 contact hours (includes lectures and class exercises): Spring Term (2 x two hour sessions per week)

How will I be Assessed?

The course is examined in the summer term. For MSc Advanced students the examination paper, duration 3 hours, has 6 questions and students must answer 3 plus one compulsory question (4 in total). The pass mark for the MSc Advanced Materials is 50%.

Reading List:

- *Ceramic processing and sintering*, M.N. Rahaman, Marcel Dekker (1995)
- *Modern Ceramic Engineering*, D. W. Richerson, Marcel Dekker
- *Glasses and the Vitreous State*, J. Zarzycki, Cambridge U.P.
- *Principles of Ceramic Processing*, James S. Reed, Wiley.

(O03) MATE97004: Polymers and Composites

Optional: For all BEng/MEng/MSc programmes

Module Leader: Milo Shaffer
Teaching Staff: Eduardo Saiz
               Florian Bouville

Why study this module?

The overall aim of this course is to introduce students to the main methods and fundamental principles used for the processing of polymers and composite materials and to develop an understanding of the factors that influence their mechanical properties.

Learning outcomes:
Identify and describe suitable methods to process polymers into useful products, including both blending and forming, for thermoplastics and thermosets.

Describe the characteristic rheology of polymers melts, and how the phenomenology controls the nature and quality of thermoplastic products, including the formation of defects.

Introduce the major types of fibre reinforcement used in structural composites, and how they compare.

Define a composite material, and give examples of common matrices and fibrous reinforcements, their properties and how they are made.

Make a quick assessment of realistic property ranges that can be obtained when making a composite of 2 materials.

Predict the elastic properties of long fibre, short fibre reinforced, and porous composites based on the properties of their constituents and architecture.

Discuss a range of failure modes for fibre reinforced composites (axial and transverse tensile failure, axial compression failure).

Appreciate the key engineering and scientific reasons for the development of metal-matrix composites.

Describe and classify processing technologies for metal-matrix and ceramic matrix composites.

Describe and understand toughening mechanisms in ceramic matrix composites.

**How will I be Taught?**

27 contact hours (includes lectures and class exercises): Spring Term (2 x two hour sessions per week)

**How will I be Assessed?**

The course is examined in the summer term. The examination paper, duration 2.5 hours, has 5 questions. Students are required to answer 3 questions.

The module contributes 100 marks of the third year. The pass mark for the individual module is 40% for BEng and MEng students. The pass mark for the MSc Advanced Materials course is 50%.

**Reading List:**

- *RJ Young and PA Lovell “Introduction to polymers” Chapman and Hall 1983*
- CB Bucknall “Toughened Plastics” *Applied Science* 1977 (Dated Introductory parts only)
- *Handbook of Ceramic Composites*, ed. by N. P. Bansal, 2005

---

**(O04) MATE97005: Electronic Structures and Opto-Electronic Properties**

Optional: For all BEng/MEng/MSc programmes

<table>
<thead>
<tr>
<th>Module Leader</th>
<th>Jason Riley</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teaching Staff</td>
<td>Mark Oxborrow, Martyn McLachlan</td>
</tr>
</tbody>
</table>

**Why study this module?**

This course describes the electronic devices used to emit light, transmit light and detect light and to show how these elements can be combined to create integrated systems for fibre optic communications, solar energy conversion and displays.

**Learning outcomes: (All)**

- Explain the background physics necessary for an understanding of the optoelectronic properties of materials;
- Discuss how reflection and refraction give rise to colour from transparent materials;
- Describe the influence of microstructure on colour (scattering and diffraction);
- Illustrate the absorption and luminescence of light from a material;
- Design a material with a specified absorption edge;
- Rationalise the broad emission obtained from a phosphor;
- Describe a fibre optic communication link;
- Compare and contrast a fibre optic links and a copper wire for data communication;
• Describe the materials used and principles of operation of light emitting diodes (LEDs) working in the visible and infra-red parts of the electromagnetic spectrum;
• Describe semiconductor lasers with reference to band gap and refractive index engineering as well as optical feedback;
• To discuss the economic and environmental viability of photovoltaic cells and define energy pay-back time;
• Justify why silicon is a material used in solar cells despite the fact that it is an indirect band gap semiconductor;
• Describe recent developments in silicon solar cell technology aimed at increasing efficiency and reducing unit cost;
• Sketch the different phases a liquid crystal may exhibit and explain how the different phases can be characterised;
• Explain why a chiral liquid crystal acts as a waveguide;
• Sketch and clearly label the key components of a liquid crystal display.

Learning outcomes: (MSc)

• Understand and describe electronic structure, hybridisation, bonding in organic semiconductors;
• Compare the properties of organic semiconductors with classical semiconductors;
• Describe the mechanism of conductivity and semiconducting behaviour in organic polymers and small molecules;
• Describe charge generation and stabilisation in organic materials;
• Define different types of organic semiconductors;
• Understand and explain the processing of organic semiconductors;
• Describe absorption and emission processes in organic semiconductors;
• Understand the operational principles, market space and design considerations of organic photovoltaic and organic light emitting diode devices.

How will I be Taught?

MSc:: 32 contact hours (includes lectures and class exercises): Spring Term (2 x two hour sessions per week).

BENG/MEng: 28 contact hours (includes lectures and class exercises): Spring Term (2 x two hour sessions per week).

How will I be Assessed?

The course is examined in the Summer term. For MSc Advanced students the examination paper, duration 3 hours, has 5 optional questions plus one compulsory question, students must answer 3 of the optional questions plus the compulsory question (4 in total). The compulsory question will be based on the lecture delivered by Professor McLachlan. The pass mark for MSc Advanced Materials students is 50%.

Reading List:

(O05) MATE97006: Nanomaterials

Optional: For all BEng/MEng/MSc programmes

Module Leader: Mary Ryan
Teaching Staff: Jason Riley
Peter Petrov

Why study this module?

This course is designed to provide the student with a fundamental understanding of nanoscience and how this can be applied in technological devices. A mechanistic description of the structure / property relationships will be covered for each class of material with a focus on the specific advantages that nanoscale materials can provide. The student will gain an understanding of the processing routes to produce controlled nanostructures.

Learning outcomes:

- Explain the effect of nanoscale structure on the mechanical properties of materials
- Describe the formation, properties and applications of nanoporous materials
- Understand the effects of surface energy on the thermodynamics of nanoscale systems
- Describe bottom-up versus top-down routes for nanomaterials processing
- Discuss nucleation versus growth of nanostructures and describe surface versus diffusion limited growth regimes
- Explain surface plasmon resonance in metals.
- Discuss why the colour of metal nanoparticles differs from that of the bulk material.
- Calculate the Bohr radius of an exciton.
- Describe quantum confinement in semiconductor Q-dots.
- Illustrate how nanowires can be employed in sensor applications.
- Describe chemical and physical methods for thin film deposition
- Understand the architecture of the CMOS transistors currently use for fabrication of integrated circuits.
- Describe the manufacturing and device performing challenges related to transistors size scaling down to 22nm, 14nm and below.
- Give examples and discuss the manufacturing process of 2D and 3D CMOS devices.
- Give examples of “post-CMOS” nanomaterials and devices
- Compare the methods for electrical testing of nanomaterials and thin film devices
- Understand and discuss the concept of responsible development; and discuss in general terms the potential impact of nanomaterials on human health and the environment

How will I be Taught?

- Introduction to Liquid Crystals: Chemistry and Physics. P.J. Collings.
- Physics of Organic Semiconductors, Brütting & Adachi (Eds).(Wiley VCH)
- Electronic Processes in Organic Semiconductors (Köhler and Bässler). (Wiley VCH)
24 lectures: Autumn Term (2 x two hour sessions per week)

How will I be Assessed?

The course is examined in the summer term. The course is examined in the summer term. For MSc Advanced students the examination paper, duration 3 hours, has 6 questions and students must answer 3 plus one compulsory question (4 in total). The pass mark for the MSc Advanced Materials is 50%.

Reading List:

- *Nanostructures and Nanomaterials - Synthesis, Properties and Applications* Guozhong Cao, Imperial College Press
- *Metal Nanoparticles – Synthesis, Characterization and Applications* D. Feldheim and C. Foss, Marcel Decker

(O06) MATE97007: Biomaterials

Core: MEng Biomaterials and Tissue Engineering
Optional: For all other programmes

Module Leader: Julian Jones

Teaching Staff: Stefano Angioletti-Uberti
Priya Pavan
Adam Celiz

Why study this module?

This course is designed to give students the firm foundation in the fundamentals of Biomaterials required in subsequent years of study for those taking Advanced Biomaterials in year 4/ MSc and for those taking the MEng in Biomaterials and Tissue Engineering and to serve as a self-standing unit.

The mission of the Biomaterials module is to explain the types and properties of materials needed for various medical applications and how to synthesise and characterise these materials.

Learning outcomes:

- Identify various components of the human body, describe their function and explain the effects of ageing on the structure and mechanical properties of various groups of tissues and organs.
- Describe the major classes of biomedical implant materials, their means of fixation, stability and advantages and disadvantages when used as implant devices.
- Discuss how different types of materials behave post implantation in the human body.
- Explain the types of failure of implants and devices in various clinical applications and reasons for failure.
- Defend the relative merits of replacing a body part with a tissue engineering construct, discuss the principals involved in growing body parts in vitro and describe the physiological and clinical limitations involved.
- Be capable of rapidly researching the literature for new developments in replacement of tissues and organs.
- Be able to communicate alternative means to repair or replace parts of the body to both healthcare professionals and patients.

**How will I be Taught?**

23 lectures, 4 feedback sessions, 1 revision class: 23 lectures and 3 feedback session in Autumn Term (2 x two hour sessions per week), with a feedback session and a revision class in Spring Term.

New material will be introduced to you in lectures. You will have an opportunity to test your understanding of the material through non-assessed problem sheets that will be reviewed in Feedback Sessions, as part of the lecture timetable.

A published book has been created as a companion to the course. This also contains a CDROM that has supplementary lectures and study questions. Copies are available in the library.

**How will I be Assessed?**

The course is examined in the summer term. The examination paper, duration 2.5 hours, has 5 questions of which students must answer 3 (20 marks per question).

The module contributes 100 marks of the third year. The pass mark for the individual module in the BEng scheme and MEng scheme is 40%. The pass mark for the MSc programmes is 50%.

**Reading List:**


(O07) MATE97009: Surfaces and Interfaces

**Optional:** For all BEng/MEng/MSc programmes
Module Leader: Sandrine Heutz
Teaching Staff: David Payne, Katharina Marquardt

Why study this module?
This course is designed to provide the students with the basic knowledge of the properties of surfaces and interfaces, focusing on their structure, energy, electronic and chemical properties. Consequences in a range of applications including thin film growth, the shape of nanostructures, the underlying physics of electronic and magnetic devices, will be discussed. The course will provide a thorough overview of the typical analytical techniques used to characterise surfaces and buried interfaces.

How will I be Taught?

Structure of surfaces (4 hours)
- Nomenclature
- Defects
- Techniques: LEED, RHEED, STM/SPM, GIXD

Energy of surfaces (2 hours)
- Surface free energy, surface tension
- Curved interfaces

Electronics and chemical bonding at interfaces (6 hours)
- Recap on bonding
- Charge distribution at surfaces and interfaces
- Electronic states at surfaces
- Techniques: XPS, HAXPES, UPS

Reactions at surfaces (3 hours)
- Adsorption: chemisorption vs physisorption
- Diffusion
- Introduction to film growth (link with MSE412)

Characterising buried interfaces (3 hours)
- TEM, SIMS, EXAFS, neutron reflectivity
- Grain boundaries

Case studies (3 hours)
- Topical examples chosen to reflect current challenges, e.g. in the areas of Energy, IT, health, nanotechnology.

Structure, teaching and learning methods:
21 lectures Spring term
3 hours student-led article discussion

Course Materials

<table>
<thead>
<tr>
<th></th>
<th>Lecture</th>
<th>Handouts</th>
<th>Tutorial Sheets</th>
</tr>
</thead>
<tbody>
<tr>
<td>PowerPoint</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lecture</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Handouts</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tutorial Sheets</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
How will I be Assessed?

Examination

The course is examined in the summer term. The examination paper has a duration of 2.5 hours. It contains 5 long questions worth 20 marks each, and the students should answer three of those.

Coursework

20 marks are associated with the article presentation exercise (preparation and presentation).

The pass mark for the BEng/MEng cohort is 40% and for the MSc Advanced Materials Science and Engineering programme is 50%. The module contributes 100 marks of the BEng and MEng year 3 programmes.

Reading List:

A = required, B = recommended but not essential, C = background reading.

- A) Surface Analysis - The Principal Techniques, John C. Vickerman, Ian S. Gilmore
- B) Surfaces and Interfaces of Solids, Hans Lüth
- C) Physics of Surfaces and Interfaces, Harald Ibach

MATE97009 Surfaces and Interfaces – Essay Paper Coursework Information

<table>
<thead>
<tr>
<th>Module:</th>
<th>MATE97009 - Surfaces and Interfaces</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assessment/Coursework Name</td>
<td>Essay Paper</td>
</tr>
<tr>
<td>Academic in charge</td>
<td>Sandrine Heutz</td>
</tr>
<tr>
<td>Method of submission</td>
<td>Blackboard Learn only</td>
</tr>
<tr>
<td>Student’s self-study hours: e.g. 10-15 hours of self-study required</td>
<td>6</td>
</tr>
<tr>
<td>Assignment details:</td>
<td>Students will research a paper that includes at least one topic related to surface science and that relates to at least one theme of the department of Materials. They will then write an essay on the paper, developing a critical discussion of the surface science aspects</td>
</tr>
</tbody>
</table>
presented in the paper, and giving suggestions for alternative surface science-based approaches to provide further insights into the research problem.

They will then present the paper in a 3-minute “Pecha-Kucha” oral presentation to the rest of the class.

| Other requirements (if applicable): | Essay - 1 page with minimum font size 11. |

### MATE97009 Surfaces and Interfaces – “Pecha-Kucha” Presentation

**Coursework Information**

<table>
<thead>
<tr>
<th>Module:</th>
<th>MATE97009 - Surfaces and Interfaces</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assessment/Coursework Name</td>
<td>“Pecha-Kucha” presentation</td>
</tr>
<tr>
<td>Academic in charge</td>
<td>Sandrine Heutz</td>
</tr>
<tr>
<td>Method of submission:</td>
<td>Blackboard Learn only for slides.</td>
</tr>
<tr>
<td>Student’s self-study hours: e.g. 10-15 hours of self-study required</td>
<td>6</td>
</tr>
<tr>
<td>Assignment details:</td>
<td>Students will present the paper from the literature related to surfaces and interfaces in a 3-minute oral presentation to the rest of the class.</td>
</tr>
<tr>
<td>Other requirements (if applicable):</td>
<td>Presentation: template provided, includes 9 slides scrolling every 20 seconds.</td>
</tr>
</tbody>
</table>

### MATE97009 Surfaces and Interfaces – “Pecha-Kucha” Presentation Rubric:

<table>
<thead>
<tr>
<th>Item name/number</th>
<th>Value</th>
<th>Description of marking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall structure and timekeeping</td>
<td>2</td>
<td>2 - excellent, perfect timing, logical structure, nothing missing 1- some vagueness, not quite to time, too long or too short 0 - no structure, no timing, poor effort</td>
</tr>
<tr>
<td>Use and quality of slides / figures / other media</td>
<td>2</td>
<td>2-No errors, well laid out, figures easily understood, perfectly applied into the talk 1- Generally good, some errors/poor layout, most figures useful 0 - unreadable, figures do not help</td>
</tr>
<tr>
<td>Technical &amp; scientific content</td>
<td>5</td>
<td>5 - perfect, very high level and high engagement at that level 4 - very good, could have been more detailed 2/3- acceptable, some understanding demonstrated, no depth 0/1 -no understanding, no content</td>
</tr>
</tbody>
</table>
(O08) MATE97011: Modelling Materials with Density-Functional Theory

Optional: For all MEng/MSc programmes
Prerequisites: N/A

Module Leader: Johannes Lischner
Teaching Staff: Laura Ratcliff

Why study this module?
This course will introduce students to the modelling of materials with density-functional theory. After a brief review of the quantum-mechanical foundations of density-functional theory, the course will focus on the application of this technique to the calculation of material properties, such as elastic constants, equilibrium structures, phase diagrams or band structures. The concepts introduced in the lectures will be put to practical use in the computer lab session, where students will learn to use a density-functional theory software package and compute the properties of real materials from first principles.

Learning outcomes:
• Explain the basic principles and capabilities of materials modeling with density functional theory (DFT)
• Explain the quantum-mechanical basis of DFT and its limitations
• Use a standard DFT software package to compute material properties, including
  • The total energy of the electronic ground state
  • Atomic forces using the Hellmann-Feynman theorem
  • Equilibrium structures of molecules and crystals
  • Elastic constants
  • Energies of vibrations in molecules and solids
  • Phonon band structure and density of states
  • IR and Raman intensities
  • Cohesive energies
  • Phase diagrams
  • Electronic band structures of metals, insulators and semiconductors
  • The dielectric function of a solid and optical properties
  • The effect of approximations to exchange and correlation on calculated properties
  • The effect of pseudopotential approximations on calculated properties
How will I be Taught?
12 lectures and 12 computer lab sessions: Autumn Term (a three hour session per week)

How will I be Assessed?
Assessment is through weekly problem sets and a written exam. The problem sets are worth 40% and the exam 60%.
The pass mark for the module is 40% for MEng students and for MSc students the pass mark is 50%. The module contributes 100 marks of the fourth year.

Reading List:

### MATE97011 Modelling Materials with Density Functional Theory - Homework Problem 1 Coursework Information

<table>
<thead>
<tr>
<th>Module:</th>
<th>MATE97011 - Modelling Materials with Density Functional Theory</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assessment/Coursework Name</td>
<td>Homework Problem 1</td>
</tr>
<tr>
<td>Academic in charge</td>
<td>Johannes Lischner</td>
</tr>
<tr>
<td>Method of submission</td>
<td>Blackboard Learn</td>
</tr>
<tr>
<td>Student’s self-study hours: e.g. 10-15 hours of self-study required</td>
<td>10-15 hours of self-study required</td>
</tr>
<tr>
<td>Assignment details:</td>
<td>Assignment details will be provided by the academic in charge.</td>
</tr>
</tbody>
</table>

### MATE97011 Modelling Materials with Density Functional Theory - Homework Problem 2 Coursework Information

<table>
<thead>
<tr>
<th>Module:</th>
<th>MATE97011 - Modelling Materials with Density Functional Theory</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assessment/Coursework Name</td>
<td>Homework Problem 2</td>
</tr>
<tr>
<td>Academic in charge</td>
<td>Johannes Lischner</td>
</tr>
<tr>
<td>Method of submission</td>
<td>Blackboard Learn</td>
</tr>
<tr>
<td>Student’s self-study hours: e.g. 10-15 hours of self-study required</td>
<td>10-15 hours of self-study required</td>
</tr>
</tbody>
</table>
### MATE97011 Modelling Materials with Density Functional Theory - Homework Problem 3 Coursework Information

<table>
<thead>
<tr>
<th>Module:</th>
<th>MATE97011 - Modelling Materials with Density Functional Theory</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assessment/Coursework Name</td>
<td>Homework Problem 3</td>
</tr>
<tr>
<td>Academic in charge</td>
<td>Johannes Lischner</td>
</tr>
<tr>
<td>Method of submission</td>
<td>Blackboard Learn</td>
</tr>
<tr>
<td>Student’s self-study hours: e.g. 10-15 hours of self-study required</td>
<td>10-15 hours of self-study required</td>
</tr>
<tr>
<td>Assignment details:</td>
<td>Students will study the convergence of density functional theory calculations. Further assignment details will be provided by the academic in charge.</td>
</tr>
</tbody>
</table>

### MATE97011 Modelling Materials with Density Functional Theory - Homework Problem 4 Coursework Information

<table>
<thead>
<tr>
<th>Module:</th>
<th>MATE97011 - Modelling Materials with Density Functional Theory</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assessment/Coursework Name</td>
<td>Homework Problem 4</td>
</tr>
<tr>
<td>Academic in charge</td>
<td>Johannes Lischner</td>
</tr>
<tr>
<td>Method of submission</td>
<td>Blackboard Learn</td>
</tr>
<tr>
<td>Student’s self-study hours: e.g. 10-15 hours of self-study required</td>
<td>10-15 hours of self-study required</td>
</tr>
<tr>
<td>Assignment details: Please enter details of what the students are required to do. The text below will be copied directly into the student handbooks.</td>
<td>Students will study the electronic structure of two-dimensional boron nitride sheets. Further assignment details will be provided by the academic in charge.</td>
</tr>
</tbody>
</table>

### MATE97011 Modelling Materials with Density Functional Theory - Homework Problem 5 Coursework Information

<table>
<thead>
<tr>
<th>Module:</th>
<th>MATE97011 - Modelling Materials with Density Functional Theory</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assignment details: Please enter details of what the students are required to do. The text below will be copied directly into the student handbooks.</td>
<td>Students will study the electronic structure of diatomic molecules. Further assignment details will be provided by the academic in charge.</td>
</tr>
</tbody>
</table>
### MATE97011 Modelling Materials with Density Functional Theory - Homework Problem 5 Coursework Information

<table>
<thead>
<tr>
<th>Module:</th>
<th>MATE97011 - Modelling Materials with Density Functional Theory</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assessment/Coursework Name</td>
<td>Homework Problem 5</td>
</tr>
<tr>
<td>Academic in charge</td>
<td>Johannes Lischner</td>
</tr>
<tr>
<td>Method of submission</td>
<td>Blackboard Learn</td>
</tr>
<tr>
<td>Student’s self-study hours: e.g. 10-15 hours of self-study required</td>
<td>10-15 hours of self-study required</td>
</tr>
<tr>
<td>Assignment details:</td>
<td>Students will study the properties of a vacancy in silicon.</td>
</tr>
<tr>
<td></td>
<td>Further assignment details will be provided by the academic in charge.</td>
</tr>
</tbody>
</table>

### MATE97011 Modelling Materials with Density Functional Theory - Homework Problem 6 Coursework Information

<table>
<thead>
<tr>
<th>Module:</th>
<th>MATE97011 - Modelling Materials with Density Functional Theory</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assessment/Coursework Name</td>
<td>Homework Problem 6</td>
</tr>
<tr>
<td>Academic in charge</td>
<td>Johannes Lischner</td>
</tr>
<tr>
<td>Method of submission</td>
<td>Blackboard Learn</td>
</tr>
<tr>
<td>Student’s self-study hours: e.g. 10-15 hours of self-study required</td>
<td>10-15 hours of self-study required</td>
</tr>
<tr>
<td>Assignment details:</td>
<td>Students will study atomic vibrations in cumulene.</td>
</tr>
<tr>
<td></td>
<td>Further assignment details will be provided by the academic in charge.</td>
</tr>
</tbody>
</table>

### MATE97011 Modelling Materials with Density Functional Theory - Homework Problem 7 Coursework Information

<table>
<thead>
<tr>
<th>Module:</th>
<th>MATE97011 - Modelling Materials with Density Functional Theory</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assessment/Coursework Name</td>
<td>Homework Problem 7</td>
</tr>
<tr>
<td>Academic in charge</td>
<td>Johannes Lischner</td>
</tr>
<tr>
<td>Method of submission</td>
<td>Blackboard Learn</td>
</tr>
<tr>
<td>Student’s self-study hours: e.g. 10-15 hours of self-study required</td>
<td>10-15 hours of self-study required</td>
</tr>
</tbody>
</table>
Assignment details: Students will study the specific heat of diamond.
Further assignment details will be provided by the academic in charge.

**MATE97011 Modelling Materials with Density Functional Theory - Homework Problem 8 Coursework Information**

<table>
<thead>
<tr>
<th>Module:</th>
<th>MATE97011 - Modelling Materials with Density Functional Theory</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assessment/Coursework Name</td>
<td>Homework Problem 8</td>
</tr>
<tr>
<td>Academic in charge</td>
<td>Johannes Lischner</td>
</tr>
<tr>
<td>Method of submission</td>
<td>Blackboard Learn</td>
</tr>
<tr>
<td>Student’s self-study hours: e.g. 10-15 hours of self-study required</td>
<td>10-15 hours of self-study required</td>
</tr>
<tr>
<td>Assignment details:</td>
<td>Students will study the magnetic properties of nickel oxide. Further assignment details will be provided by the academic in charge.</td>
</tr>
</tbody>
</table>

(O09) **MATE97013: Advanced Engineering Alloys**

**Optional: For all MEng/MSc programmes**

**Prerequisites:** MATE96003 (MSE 307)

<table>
<thead>
<tr>
<th>Module Leader:</th>
<th>Fionn Dunne</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teaching:</td>
<td>Chris Gourlay</td>
</tr>
</tbody>
</table>

**Why study this module?**

This course titled ‘Advanced Engineering Alloys’ builds on knowledge acquired from MSE307 (Engineering Alloys) and addresses aspects of processing (particularly casting) through to resultant microstructure and properties, and then considers alloy structural behaviour and performance in service under mechanical and thermal loading.

The links between processing, microstructure, properties and performance of engineering alloys in service are emphasised. Two case studies, one in each of processing and performance, are included to relate the course content to engineering practice and to reinforce the process-microstructure-properties-performance paradigm.

**Learning outcomes:**

- use heat transfer approaches to calculate and estimate casting parameters
- understand interface undercooling and constitutional supercooling and their role in (i) the columnar-to-equiaxed transition and (ii) the control of grain size.
- understand the physical basis for the Jackson-Hunt equations for regular eutectic growth and use it to predict interphase spacings and eutectic morphologies
• understand competitive solidification criteria for single phase dendrites vs. fully-eutectic growth;
• calculate simple microstructure selection maps from solidification models and data and use them to predict microstructures from processing parameters.
• Use all of the above to discuss microstructure selection in light alloy castings for aerospace applications
• understand generalized crystal deformation – stretch, slip and rigid body rotation
• understand slip in fcc, bcc, and hcp crystal lattices and slip systems, Schmid rule, strain from slip, strain and rotation rates
• understand and use slip rules and slip by dislocation glide and thermally-activated climb; self and latent hardening
• understand EBSD, texture and its representation, pole figures and Kearns factors;
• cold dwell fatigue in the Ti alloys; mechanistic assessment, crystallography; role of rate sensitivity; load shedding; microstructure (morphology and micro-texture); thermal alleviation

How will I be Taught?
24 lectures in the Spring Term ((2 x two hour sessions per week)

How will I be Assessed?
The course is examined in the summer term. The examination is 2.5 hours and consists of 5 questions, of which the students have to answer 3. Questions could be from a single part of the course or be more general in nature and require the students to use elements from several parts of the course.

The pass mark for the module is 40% for MEng students and for MSc students the pass mark is 50%. The module contributes 100 marks of the fourth year.

Reading List:
• Links to underpinning scientific journal papers are provided on WebCT
• Roters, F, Eisenlohr, P, Bieler, TR, Raabe, D, Crystal Plasticity Finite Element Methods, Wiley-VCH, 2010

(O10) MATE97015: Advanced Thin Film Manufacturing Technologies

Optional: For all MEng/MSc programmes
Prerequisites: N/A

Module Leader: Peter Petrov
Why study this module?

This course titled ‘Advanced Thin Films Manufacturing Technologies’ aims to familiarise students with the basic vacuum technologies; explain the essential concepts involved in using vapour and solution-based deposition techniques to develop thin films; provide a foundation required to successfully use lithographic and other microfabrication methods; provide students with the basics for working in, and understanding the microfabrication production environment.

Learning outcomes:

- Explain the principles of vacuum production and its classification.
- Understand the working principles and limitations of the vacuum pumps and gauges.
- Understand the essential concepts involved in using vapour and solution deposition techniques to grow thin films.
- Describe the most common types of vapour deposition technologies (chemical vapour deposition (CVD), physical vapour deposition (PVD) and mixed deposition), as well as solution-based processing methods.
- Explain the three basic PVD techniques: vacuum evaporation (thermal/e-beam evaporation), sputter deposition (DC-, RF-, reactive- magnetron sputtering) and pulsed laser deposition.
- Discuss the connection between vapour and solution deposition parameters and thin film properties.
- Identify the most appropriate methods/equipment for a deposition process and discuss its advantages and disadvantages.
- Understand the characteristics and practical limitations of basic lithographic methods used for integrated circuit manufacturing.
- Discuss and compare the etching methods used in a microfabrication process.
- Identify the most appropriate method and equipment for a patterning process and outline their principles of operation and limitations.
- Understand the basics principles for working in hi-tech (e.g. semiconductor) production environment.
- Know the classification of cleanrooms, its design principles and control measures.

How will I be Taught?

27 lecture hours and 3 workshop sessions (2 hours each) in the Autumn Term ((2 x two-hour sessions per week)

How will I be Assessed?

Examination (80%)

The course is examined in the summer term. The exam is 2.5 hours and consists of 5 questions from which the students must answer 3.

Coursework (20%)

This will be comprised of 3x two-hour workshops (worth 3% each) and a 10-page report (worth 11%). The report will detail the manufacturing process for an electronic device. For the
electronic device, students will be allocated to one of three options. The report will need to cover i) the main deposition process and the equipment needed to build the deposition setup, ii) how the different layers in the electronic device can be processed (e.g. deposited and patterned), iii) the overall manufacturing work-flow, including the intermediate processes involved (e.g. cleaning and quality control) as well as suggestions on the production environment. These three topics will be discussed in one workshop each, in which students work together in a team to design the manufacturing process and equipment.

Each workshop will be marked based on engagement (3%). The reports will need to be written individually. The report will be assessed based on accuracy and completeness.

The pass mark for the module is 40% for MEng students and for MSc Advanced Materials Science and Engineering students, it is 50%, formed from at least 40% Examination and at least 10% Coursework.

Reading List:
- Fundamentals of Vacuum Technology (revised and compiled by W Umrath) Oerlikon Leybold Vacuum 00.200.02 Kat.-Nr. 199 90

MATE97015 Advanced Thin Films Manufacturing – Device Manufacturing Route Report and Workshops Coursework Information

| Module: | MATE97015 - Advanced Thin Films Manufacturing |
| Assessment/Coursework Name | Device manufacturing route report and workshops |
| Academic in charge | Petrov and Hoye |
| Method of submission | Blackboard Learn |
| Student’s self-study hours: e.g. 10-15 hours of self-study required | 20 hours |
| Assignment details: | To prepare for and attend 3x workshops and write a 10 page report |
MATE97015 Advanced Thin Films Manufacturing – Device Manufacturing Route Report and Workshops Rubric:

<table>
<thead>
<tr>
<th>Item name/number</th>
<th>Value</th>
<th>Description of marking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Performance at workshop (x3)</td>
<td>9</td>
<td>1- attended; 2 - engaged with the discussion; 3 - exceptional contribution to the discussion</td>
</tr>
<tr>
<td>Report:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>i) Introduction</td>
<td>1</td>
<td>completeness and level of discussion</td>
</tr>
<tr>
<td>ii) Manufacturing workflow</td>
<td>3</td>
<td>completeness and level of discussion</td>
</tr>
<tr>
<td>iii) The most challenging fabrication process</td>
<td>3</td>
<td>completeness and level of discussion</td>
</tr>
<tr>
<td>iv) Equipment (for the most challenging fabrication process)</td>
<td>3</td>
<td>completeness and level of discussion</td>
</tr>
<tr>
<td>v) Conclusions</td>
<td>1</td>
<td>completeness and level of discussion</td>
</tr>
</tbody>
</table>

(O11) MATE97017: Electroceramics

**Optional:** For all MEng/MSc programmes

**Prerequisites:** N/A

**Module Leader:** Stephen Skinner

**Teaching Staff:** Ainara Aguadero

**Why study this module?**

The aim of the course is to gain an understanding of the fundamental science governing the electronic and ionic conductivity of metal oxides and to then use this knowledge to describe the operation of devices based on these properties, such as gas sensors, fuel cells, electrolyseres, batteries and thermoelectrics.

**Learning outcomes:**
• Obtain a full set of algebraic expressions for the point defect concentrations in pure and doped oxide materials.
• Identify suitable approximations to the full neutrality condition, and hence solve the defect equations and construct a simple Brouwer diagram for a binary oxide.
• Construct expression for the incorporation of extrinsic defects and incorporate this in the Brouwer diagram
• Discuss type of conductivity and applicability of materials in electrochemical systems
• Describe the operation of secondary batteries. Identify different electrode reaction mechanisms in secondary batteries
• Analyse electrochemical performance in terms of the band theory of solids
• Discuss electrode and electrolyte materials chemical and electrochemical stability properties
• Describe different types of solid electrolytes and ionic conduction mechanisms for alkaline ions.
• Discuss relationships between crystal structure, composition and morphology with transport properties.
• Identify novel materials for ceramic based devices. Explain further alternatives for high energy batteries development
• Explain the concept of anionic, cationic and mixed conductors.
• Derive a simple relationship for the operation of a ceramic membrane device and use this expression to select appropriate materials for the fabrication devices such as a single SOFC cell
• Explain the operation of a fuel cell and give an account of the basic details of the four main types of cell.
• Describe the operation of two oxide-based sensors
• Describe a further sensor based on the amperometric technique
• Describe two simple sensors for the detection of flammable gasses
• Be able to describe the key features of thermoelectric materials

How will I be Taught?
24 lecture hours in the Autumn Term ((2 x two hour sessions per week)

How will I be Assessed?
The course is examined in the summer term. The examination paper, duration 2.5 hours, is in two sections. Section A (20 marks) is compulsory and consists of a single question on all parts of the course. Section B contains 3 questions of which students must answer 2 (20 marks per question).

The pass mark for the module is 40% for MEng students and for MSc students the pass mark is 50%. The module contributes 100 marks of the fourth year.

Reading List:
• Electroceramics, A.J.Moulson and J.M.Herbert
• Physical Ceramics, Chiang, Birnie and Kingery, John Wiley and Sons (1997)
• Electronic Ceramics Properties Devices and Applications Lionel M. Levinson Marcel
(O12) MATE97019: Nanomaterials II

Optional: For all MEng/MSc programmes
Prerequisites: MATE96007/97006

<table>
<thead>
<tr>
<th>Module Leader:</th>
<th>Cecilia Mattevi</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teaching Staff:</td>
<td>Ifan Stephens</td>
</tr>
<tr>
<td></td>
<td>Alex Porter</td>
</tr>
<tr>
<td></td>
<td>Fang Xie</td>
</tr>
<tr>
<td></td>
<td>Ludmilla Steier</td>
</tr>
</tbody>
</table>

Why study this module?

This course is designed to provide the students with an insight into the emerging applications of nanotechnology through a series of topically relevant case studies. The underlying nanoscience as well as the engineering aspects of material and device operation is given. The broader societal impacts of nanotechnology and its impact on human health are explored.

Learning outcomes:

- Describe the electronic band structure of graphene and of monolayered transition metal (group VI) disulphide and diselenide (e.g. MoS2).
- Discuss the optical, electrical and catalytic properties of these materials.
- Discuss the liquid phase synthesis method for these materials.
- Discuss their applications.
- Quantify the scalability of different energy conversion technologies for our future energy needs.
- Explain the role of the electrocatalyst in controlling the efficiency of low temperature fuel cells and water electrolysis.
- Describe trends in catalytic activity due to (i) particle size (ii) alloying.
- Identify fundamental bottlenecks in emerging electrochemical reactions: N2 reduction and CO2 reduction.
- Plasmonic materials: synthesis and fabrication.
- Optical properties of plasmonic materials.
- Biosensing and bioimaging
- Solar energy enhancing for water splitting and solar cells.
- Discuss the principles, mechanisms and historic development of the atomic layer deposition (ALD) technique.
Discuss the principles of charge extraction and blocking layers in solar cells, energy band alignment in different types of solar cells when ALD materials used.
Discuss the principles of photoelectrochemical cells when ALD materials used. in photoelectrochemical cells.
Discuss the new frontier of single atom catalysis, advantages of ALD to have control on atomic scale.
Describe the routes of exposure of nanoparticles to the body.
Understand and discuss the effect of shape, size and chemistry of nanostructures on the interaction of nanoparticles with the body.
Assess critically the potential risk of nanoparticles to human health.

How will I be Taught?
21 lecture hours in the Spring Term ((2 x two hour sessions per week) and 3 hrs of poster presentation

How will I be Assessed?
The course is examined in the summer term. The examination paper, duration 2.5 hours is in 2 sections. Section A contains 5 short calculation-type questions (6 marks each); section B contains 2 essay questions (20 marks each). All questions are compulsory.

Coursework
30 marks are associated with the poster exercise (preparation and presentation).
The pass mark for the MEng cohort is 40% and for the MSc Advanced Materials Science and Engineering course is 50%. The module contributes 100 marks of the MEng fourth year.

Reading List:
- Nanostructures and Nanomaterials - Synthesis, Properties and Applications Guozhong Cao, Imperial College Press
- Metal Nanoparticles – Synthesis, Characterization and Applications D. Feldheim and C. Foss, Marcel Decker

MATE97019 Nanomaterials II – Presentation Abstract Coursework Information

<table>
<thead>
<tr>
<th>Module:</th>
<th>MATE97019 - Nanomaterials 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assessment/Coursework Name</td>
<td>Presentation Abstract</td>
</tr>
<tr>
<td>Academic in charge</td>
<td>Dr Cecilia Mattevi</td>
</tr>
<tr>
<td>Method of submission</td>
<td>Blackboard Learn only</td>
</tr>
<tr>
<td>Student’s self-study hours: e.g. 10-15 hours of self-study required</td>
<td>15-18 hours of self-study required</td>
</tr>
<tr>
<td>Assignment details:</td>
<td>Group of 3-5 students are required to prepare a presentation on a topic provided by the</td>
</tr>
</tbody>
</table>
Students should first perform an in-depth literature search on the topic, select a subtopic on which to focus their presentation and read more in specific on that.

Students should first formulate an abstract of their presentation content on which to receive feedback from the course leader.

The abstract is not assessed.

### MATE97019 Nanomaterials II – Presentation Slides Coursework Information

<table>
<thead>
<tr>
<th>Module</th>
<th>MATE97019 - Nanomaterials 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assessment/Coursework Name</td>
<td>Presentation using slides (power point)</td>
</tr>
<tr>
<td>Academic in charge</td>
<td>Dr Cecilia Mattevi</td>
</tr>
<tr>
<td>Method of submission</td>
<td>Blackboard Learn only</td>
</tr>
<tr>
<td>Student’s self-study hours: e.g. 10-15 hours of self-study required</td>
<td>15-18 hours of self-study required</td>
</tr>
</tbody>
</table>

**Assignment details:**

Group of 3-5 students are required to prepare a power point slide-based presentation on a topic provided by the course leader. Students should first perform an in-depth literature search on the topic, select a subtopic on which to focus their presentation and read more in specific on that.

After receiving feedback on the abstract, students can prepare a presentation in the form of slides to be presented in 12 minutes.

The presentation will be assessed.

### MATE97019 Nanomaterials II – Presentation Slides Rubric:

<table>
<thead>
<tr>
<th>Item name/number</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Presentation skills</td>
<td>10</td>
</tr>
<tr>
<td>The scientific quality of slides content</td>
<td>10</td>
</tr>
<tr>
<td>Answers to questions</td>
<td>10</td>
</tr>
</tbody>
</table>
(O13) MATE97021: Advanced Structural Ceramics

Optional: For all MEng/MSc programmes
Prerequisites: MATE96004 is useful but not required; MATE96004 can be usefully taken after MATE97021

Module Leader: Luc Vandeperre
Teaching Staff: Finn Giuliani
              Florian Bouville

Why study this module?
This course is designed to review microstructural aspects of the behaviour of major ceramic families such as alumina, silicon carbide, silicon nitride, zirconia and glass and contrast microstructural control aimed at improving strength/toughness and to re-examine the general theoretical concepts underpinning the structural performance of materials developed in earlier mechanical behaviour courses with an aim to strengthen the students ability to apply the general principles to ceramics.

Learning outcomes:
- State a range of classical families of advanced structural ceramics including alumina, zirconia, silicon nitride, silicon carbide and ceramic matrix composites
- List and explain approaches to improve the strength and toughness of these materials
- List and explain a range of ceramic composite approaches and their failure modes
- Outline how colloidal processing can be used to increase the toughness of technical ceramics through microstructural control
- Distinguish between inherent toughness, apparent toughness, and fracture energy
- Predict crack progression for stable cracking and for materials with R-curve behaviour
- Have some understanding of possible fatigue effects in ceramics
- Inspect a ceramic fracture surface and determine failure origin, and failure type
- Estimate the probability of failure for simple loading cases
- Incorporate proof testing or non-destructive evaluation in a reliability strategy
- Outline a design methodology for complex ceramic components based on probability of failure
- Compare and contrast deformation behaviour of ceramics with other materials
- Identify the deformation mechanisms active in ceramics
- Understand the importance of thermo-mechanical properties at temperature
- Understand the effect of scale in testing of materials
- Understand the thermodynamics and kinetics behind degradation mechanisms of ceramic at high temperature due to stress including creep, fatigue and thermal shock, due to corrosion or due to radiation

How will I be Taught?
26 contact hours in the Autumn Term (2 x two hour sessions per week).

How will I be Assessed?
The course is examined in the summer term. The exam paper is 2.5 hours and consists of 5 questions, students should answer 3 questions.

The pass mark for the module is 40% for MEng students and for MSc students the pass mark is 50%. The module contributes 100 marks of the fourth year.

Reading List:
- Links to research papers are provided on Blackboard

(O14) MATE97023: Nuclear Materials

Core: MSc Nuclear Theme and MEng Nuclear degree course
Optional: For all Meng and IDX
Prerequisites: ‘Introduction to Nuclear Energy’ may be helpful (if available to you)

Module Leader: Mark Wenman
Teaching Staff: Robin Grimes
Ben Britton

Why study this module?

The aim is to develop an appreciation of materials issues associated with nuclear reactor technology and how this information is used when designing reactor systems. A mechanistic description of materials selection for intense radiation fields and the associated degradation mechanisms will be covered for different classes of material with a focus on the specific advantages and disadvantages. The course will then cover specific cases where materials issues have been crucial to systems performance and a variety of degradation and failure mechanisms as well as the radiation damage processes that brought about these failures. The course will assume students have a basic understanding of a reactor system by either attending the nuclear introduction course or through some hours of self-study. NB: Although not solely focused on water reactor systems (especially PWR) the course will be aimed at these system

Learning outcomes:
- Review radiation types, radioactive decay and dose units.
- Discuss the mechanisms of radiation damage of nuclear materials, the units used to measure damage and the models behind them.
- Recall the types of fuel and components for the Nuclear Fuel Assembly.
- Discuss the fuel cycle, fuel fabrication and fuel performance.
- Explain the use of different materials (stainless steels, Ni alloys) used in a PWR primary circuit and the problems and mitigation strategies associated with them.
- Understand the microstructure and mechanical properties of ferritic steels used for reactor pressure vessels (including welded structures) and the degradation of the steels due to neutron irradiation.
- Outline the motivation for zirconium as a cladding in PWR environments
• Discuss alloying of zirconium for cladding materials
• Discuss engineering decisions for tube fabrication, as well as a simple overview of the benefits and disadvantages of different joining technologies.

**How will I be Taught?**

27 total lecture/workshop hours in the Autumn Term.

**How will I be Assessed?**

The course is examined in the summer term, and the students answer any 3 of 5 questions.

The pass mark for the MEng cohort is 40% and for the MSc/MRes courses is 50%. The module contributes 100 marks of the MEng fourth year, or a core module for MSc/MRes.

**Reading List:**

• G. R. Odette and S. J. Zinkle (Editors) Structural Alloys for Nuclear Energy Applications (978-0-12-397046-6).
• P D Wilson (Editor) “The Nuclear Fuel Cycle: From Ore to Waste” (0198565402W)
• * G S Was “Fundamentals of Radiation Materials Science” Springer (978-3-540-49471-3)

**(O15) MATE97025: Advanced Biomaterials**

**Core: MEng Biomaterials and Tissue Engineering**
**Optional: For MEng/MSc courses**
**Prerequisites: MSE 315**

**Module Leader:** Julian Jones

**Teaching Staff:**
Alex Porter
Stefano Angioletti-Uberti

**Why study this module?**

The course aims to introduce students to the latest developments in Advanced Materials for Orthopaedic Regeneration, Wound healing and Nanomedicine.

**Learning outcomes:**

• Explain the shortfalls of current bone and cartilage implant materials to the biomaterials industry and investors.
• Design ideal scaffold materials for bone and cartilage regeneration.
• Explain the concept of therapeutic nanoparticles.
• Be familiar with advanced microscopy techniques for following nanoparticles within cells
• Explain the concept of hybrid materials and their potential benefits for regenerative medicine over composites
• Explain the synthesis method for hybrid biomaterials and how it relates to their unique properties
• Discuss Additive Manufacturing methods for scaffold production
• Discuss antiviral nanoparticles
• Describe hydrophilic / hydrophobic interactions between materials and proteins using mathematical operations
• Mathematically define ligand-receptor interactions
• Explain how cells can be targeted by nanoparticles and discuss the efficiency of targeting.
• Discuss the deformation of soft membranes
• Explain the challenges involved with transfer of laboratory inventions to a clinical product
• Production and application of HA and bioactive glass nanoparticles
• Cell uptake routes and nanotoxicity of classes of nanoparticles
• Describe cancer treatment through the use of particles
• Discuss new biomaterials for healing of chronic wounds.

How will I be Taught?

24 lecture hours + 3 feedback sessions in the Spring Term (2 x two hr sessions per week) plus a revision lecture in the Summer Term. Feedback sessions will be based on selected past exam questions, which students should complete prior to the sessions.

How will I be Assessed?

The course is examined in the summer term. The exam is 2.5 hours in duration and consists of 5 questions, from which students must answer 3 questions (each marked out of 20).

The pass mark for the MEng cohort is 40% and for an MSc course is 50%. The module contributes 100 marks of the fourth year.

Reading List:

• Various printed publications, supplies as pdfs

(O16) MATE97027: Advanced Tissue Engineering

Core: MEng Biomaterials and Tissue Engineering
Optional: For MEng/MSc courses and IDX
Prerequisites: See below
**Module Leader:** Iain Dunlop  
**Teaching Staff:**  
Theoni Georgiou  
Molly Stevens

### Why study this module?

#### Aims:
The course will introduce students to key concepts and recent developments in soft tissue engineering, with a particular focus on biomaterials-based approaches. This is a highly dynamic and rapidly developing field, with rapid advances in both fundamental biology and biomaterials design driving a stream of new clinical and pre-clinical approaches.

#### Context/Prerequisites:
Students not taking MSE315 must have a basic foundation in cell biology, e.g. from BioEng core courses, Biochemical Engineering modules or courses taken at another university. MSE418 focuses on soft tissues and biomaterials in contrast to MSE417 which is centred on hard tissues and biomaterials: these modules may be taken in combination or separately.

#### Course content
- **Cellular responses to the local environment:** We aim to understand the principles of how cells sense and respond to the physical and chemical properties of biomaterials and of the in vivo environment.
- **Polymeric materials in tissue engineering:** Soft tissue engineering biomaterials are typically polymers and students will learn how these materials are synthesized and characterized.
- **Clinical aspects of tissue engineering:** Students will learn key clinical concepts and study clinical and pre-clinical case studies in soft tissue engineering.

Sample learning outcomes:
- Describe and explain the principles of cellular mechanotransduction.
- Describe various strategies to fabricate porous materials.
- Give examples of the applications of scaffolds for tissue engineering of heart, eye, liver, kidney and the nervous system.

### How will I be Taught?
27 lecture hours in the Spring Term (a three hr session per week)

### How will I be Assessed?
The course is examined in the summer term. The paper is 2.5 hours and students are required to answer 3 questions from the 5 set on the examination paper.

The pass mark for the MEng cohort is 40% and for an MSc course is 50%. The module contributes 100 marks of the fourth year of the MEng courses.
(O17) MATE97050: Fusion and Advanced Reactors

Optional: For MSc programmes

Module Leader: Dr Ben Britton
Teaching Staff: Dr Mark Wenman,
Dr Mike Bluck,
Professor Christos Markides
Dr Hanni Lux
Dr Christopher Ham
Prof Sergei Dudarev

Why study this module?

This module is designed to provide an introduction to next generation nuclear reactor concepts and ideas, including nuclear fusion and the advanced fission reactor (e.g. GenIV) landscape.

**Fusion:** Understand what drives the need for completely new energy sources, such as fusion; clarify the underlying science and technology challenges including the role of materials development; understand the progress to date and how this is expected to impact on the potential for fusion power as an energy system.

**Advanced reactors:** Advanced reactor concepts represent the next generation of nuclear fission reactor technologies, with aims towards energy creation which addresses more than just electricity (e.g. hydrogen production), as well as the ability to breed a mixture of nuclear fuel streams (including molten salts, thorium, and waste actinides), and the operation of reactors at higher temperatures. These reactors will operate in a new engineering space, where cost, scalability with an intermittent grid (e.g. renewables), time to market, and engineering opportunity will be seized upon.

How will I be Taught?

16 hours of lectures, 7 hours of tutorials: Autumn term

How will I be Assessed?

One hour online multiple choice test on fusion power. (50%)
Four pieces of coursework on advanced reactors. (50%)
The pass mark for the MSc Advanced programme is 50%.
Reading List:

- "Physics of Plasmas" by Boyd and Sanderson, CUP
- *Fusion, the Energy of the Universe*, McCracken, Stott, Academic Press.
- Tokamaks, Wesson, OUP.
- IWGFR "Status of Fast Reactor Research and Technology Development, TECDOC 1691", IAEA, Vienna 2013

**MATE97050 Fusion Advanced Reactors – Coursework 1 Coursework Information**

<table>
<thead>
<tr>
<th>Module:</th>
<th>MATE97050 Fusion Advanced Reactors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assessment/Coursework Name</td>
<td>Coursework 1</td>
</tr>
<tr>
<td>Academic in charge</td>
<td>Dr Ben Britton</td>
</tr>
<tr>
<td>Method of submission</td>
<td>Blackboard Learn only</td>
</tr>
<tr>
<td>Student’s self-study hours: e.g. 10-15 hours of self-study required</td>
<td>5 hours</td>
</tr>
</tbody>
</table>

**Assignment details:**

- Select one GenIV reactor design and:
  - Create of an Infographic (60% marks available) – assessed on: visual appeal; content (facts/depth/breadth); range of sources
  - Writing (up to) 500 words on the topic with a brief history, progress, and opportunities, assessment on: content, written style, and referencing (references are not included in the word count)

**MATE97050 Fusion Advanced Reactors – Coursework 1 Rubric:**

<table>
<thead>
<tr>
<th>Item name/number</th>
<th>Value</th>
<th>Description of marking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Selecting one GenIV technology - Candidates are expected to produce one ‘infographic’ targeting towards a general audience. (60% of assessment)</td>
<td>60</td>
<td>The content of the infographic will be assessed based upon the visual appeal, content, and range of sources used.</td>
</tr>
<tr>
<td>(40% of assessment)</td>
<td>40</td>
<td>Candidates are expected to write (up to) 500 words on the topic. This part of the assignment will be assessed</td>
</tr>
</tbody>
</table>
**MATE97050 Fusion Advanced Reactors – Coursework 2 Coursework Information**

<table>
<thead>
<tr>
<th>Module:</th>
<th>MATE97050 Fusion Advanced Reactors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assessment/Coursework Name</td>
<td>Coursework 2</td>
</tr>
<tr>
<td>Academic in charge</td>
<td>Dr Mike Bluck</td>
</tr>
<tr>
<td>Method of submission</td>
<td>Blackboard Learn only</td>
</tr>
<tr>
<td>Student’s self-study hours: e.g. 10-15 hours of self-study required</td>
<td>5 hours</td>
</tr>
</tbody>
</table>

**Assignment details:**

Select one Small/advanced modular reactor design and:
- Create of an Infographic (60% marks available) – assessed on: visual appeal; content (facts/depth/breadth); range of sources
- Writing (up to) 500 words on the topic with a brief history, progress and opportunities (technical and economic). Assessment based on content, written style, and referencing (references are not included in the word count)

**MATE97050 Fusion Advanced Reactors – Coursework 2 Rubric:**

<table>
<thead>
<tr>
<th>Item name/number</th>
<th>Value</th>
<th>Description of marking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Selecting one Small/advanced modular reactor technology - Candidates are expected to produce one ‘infographic’ targeting towards a general audience. (60% of assessment)</td>
<td>60</td>
<td>The content of the infographic will be assessed based upon the visual appeal, content, and range of sources used.</td>
</tr>
<tr>
<td>Writing (up to) 500 words on the topic with a brief history, progress and opportunities (technical and economic). (40% of assessment)</td>
<td>40</td>
<td>Candidates are expected to write (up to) 500 words on the topic. This part of the assignment will be assessed based upon content, written style and references used (references do not count towards the word count).</td>
</tr>
</tbody>
</table>
MATE97050 Fusion Advanced Reactors – Coursework 3 Coursework Information

| Module: | MATE97050 Fusion Advanced Reactors |
| Assessment/Coursework Name | Coursework 3 |
| Academic in charge | Dr Mark Wenman |
| Method of submission | Blackboard Learn only |
| Student’s self-study hours: e.g. 10-15 hours of self-study required | 5 hrs |
| Assignment details: | Answer in essay form 2 of the questions/discussion points discussed in class on ATF and future fuel systems each is expected to be approx. 800 words in length and contain suitable references, figures and tables if required. |

MATE97050 Fusion Advanced Reactors – Coursework 3 Rubric:

<table>
<thead>
<tr>
<th>Item name/number</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Select two questions/discussion points on ATF or advanced fuel systems (100% of assessment) Candidates are expected to write (up to) 800 words per discussion point. This part of the assignment will be assessed based upon content, written style, and references used (references do not count towards the word count).</td>
<td>0</td>
</tr>
<tr>
<td>Written style and presentation 25% including use of English.</td>
<td>25</td>
</tr>
<tr>
<td>References and use thereof 25%.</td>
<td>25</td>
</tr>
<tr>
<td>Scientific content 25%</td>
<td>25</td>
</tr>
<tr>
<td>Discussions and conclusions 25%</td>
<td>25</td>
</tr>
</tbody>
</table>

MATE97050 Fusion Advanced Reactors – Coursework 4 Coursework Information

<p>| Module: | MATE97050 Fusion Advanced Reactors |
| Assessment/Coursework Name | Coursework 4 |
| Academic in charge | Prof. Sergei Dudarev, Dr. Chris Ham, and Mr James Morris |</p>
<table>
<thead>
<tr>
<th>Method of submission</th>
<th>Blackboard Learn only</th>
</tr>
</thead>
<tbody>
<tr>
<td>Student's self-study hours: e.g. 10-15 hours of self-study required</td>
<td>5 hours</td>
</tr>
<tr>
<td>Assignment details:</td>
<td>S. Dudarev</td>
</tr>
<tr>
<td>Solve the three problems given after the lectures, using the material given in the lectures as well as information in the literature sources also mentioned in the lectures. The solutions are expected to be as detailed as possible and should provide the mathematical details of the derivations. The originality of the solutions, including the clear difference in the line of thought and approach from the solutions given by other students in the group, is going to be treated as an additional positive factor in the assessment.</td>
<td>C. Ham</td>
</tr>
<tr>
<td>Solve the five problems related to plasma physics using the material given in the lectures as well as information in the literature sources and standard textbooks on electromagnetism. The solutions are expected to be as detailed as possible and should provide the mathematical details of the derivations.</td>
<td>J. Morris</td>
</tr>
<tr>
<td>Solve two problems related to the technology and economics of nuclear fusion power. Show mathematical detail and provide detailed justifications for assumptions used.</td>
<td></td>
</tr>
</tbody>
</table>

**MATE97050 Fusion Advanced Reactors – Coursework 4 Rubric:**

<table>
<thead>
<tr>
<th>Item name/number</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>C Ham: Marks are awarded with the breakdown as indicated on the question sheet. With a total number of 34 marks available.</td>
<td>34</td>
</tr>
<tr>
<td>J Morris: Marks are awarded with the breakdown as indicated on the question sheet. With a total number of 33 marks available</td>
<td>33</td>
</tr>
<tr>
<td>S Dudarev: Marks are awarded with the breakdown as indicated on the question sheet. With a total number of 33 marks available</td>
<td>33</td>
</tr>
</tbody>
</table>
**Module:** MATE97043 - Advanced Materials Science and Engineering Research Project

**Assessment/Coursework Name:** Research Project Plan

**Academic in charge:** Dr Ifan Stephens

**Method of submission:** Blackboard Learn only

**Student’s self-study hours: e.g. 10-15 hours of self-study required:** 60h self-study. (6h/wk x 10wks)

**Assignment details:** Write a plan for the research project under the supervision of an academic. The structure (adapted from that for a major research funder) can be found in the Research Project Plan rubric.

**Other requirements (if applicable):**
This project proposal can be up to six A4 sides, including references. The minimum allowed font size is 11pt, the minimum margin width is 1.5 cm, and the minimum line spacing is single spaced.

For the references you can either use a numerical scheme:


or the Harvard scheme (recommended if you are not using reference management software):

MATE97043 Advanced Materials Science and Engineering Research Project – Research Project Plan Rubric:

<table>
<thead>
<tr>
<th>Item name/number</th>
<th>Value</th>
<th>Description of marking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Track Record [No marks]</td>
<td>0</td>
<td>One paragraph describing what your UG degree covered. -Note any previous research work you have done -Note any experimental equipment you have learned to use -Note any computational methods you have learned to use• Note any computational methods you have learned to use</td>
</tr>
<tr>
<td>Project Summary [85 marks] [approx. 4 pages]</td>
<td>40</td>
<td>• Background [40] -Introduce the project topic and explain its context -Review the state of scientific understanding in the field -Describe the gap in our knowledge that the work will address</td>
</tr>
<tr>
<td></td>
<td>20</td>
<td>• Research hypothesis and objectives [20] -Set out your research idea or hypothesis -Identify the overall aims of the project</td>
</tr>
<tr>
<td></td>
<td>25</td>
<td>• Programme and methodology [25] -Describe your research methodology -Describe the work programme, indicating what research is to be undertaken, and the order in which the work will be done.</td>
</tr>
<tr>
<td>Research Impact [5 marks]</td>
<td>5</td>
<td>One paragraph to describe how your research may be of benefit to society and the state of scientific knowledge.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Workplan [5 marks] [approx. 0.5 page]</th>
<th>5</th>
<th>Provide a diagrammatic work plan (Gantt chart).</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resources Needed [No marks]</td>
<td>0</td>
<td>List the resources you will require, and what equipment training you will need. Indicate what assistance you will require from other people. Indicate how you will use the £500 allocated to your project by the department. Please confirm this with your supervisor.</td>
</tr>
<tr>
<td>References [5 marks]</td>
<td>5</td>
<td>Provide a list of your references here; around 20 would be typical.</td>
</tr>
</tbody>
</table>

### MATE97043 Advanced Materials Science and Engineering Research Project – Final Project Presentation Coursework Information

<table>
<thead>
<tr>
<th>Module:</th>
<th>MATE97043 - Advanced Materials Science and Engineering Research Project</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assessment/Coursework Name</td>
<td>Final Project Presentation</td>
</tr>
<tr>
<td>Academic in charge</td>
<td>Dr Ifan Stephens</td>
</tr>
<tr>
<td>Method of submission</td>
<td>Oral</td>
</tr>
<tr>
<td>Student’s self-study hours: e.g. 10-15 hours of self-study required</td>
<td>10h, incl supervisor assistance, plus half day attending presentations and presenting</td>
</tr>
</tbody>
</table>

### Assignment details:

After submission and marking of the thesis you will present your results, analysis and findings to your peers. This will be a 15 minute presentation (including time for question-and-answer discussion). There will be a briefing note available on making scientific presentations. The staff present (your assessor pair, plus another assessor pair making a panel of four staff) will submit a joint assessment. Your presentation should (i) introduce the aims of the project and situate it in the context of the research literature, (ii) show the main results and findings, (iii) discuss those results and present your conclusions.

### Other requirements (if applicable):

AV equipment and a PC will be available for the use of powerpoint of other visual aids software.

### MATE97043 Advanced Materials Science and Engineering Research Project – Final Project Presentation Rubric:

<table>
<thead>
<tr>
<th>Item name/number</th>
<th>Value</th>
<th>Description of marking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Background</td>
<td>20</td>
<td>Was the scientific and technological context and motivation for the work clearly exposited?</td>
</tr>
</tbody>
</table>
Methods and Results  20  Was it clear *what* was done, *how* it was done, and were errors/uncertainties handled properly?

Discussion and Conclusions  20  Were the results discussed in the context of the literature and appropriate conclusions drawn?

Oral Presentation  20  Was the oral presentation, including questions, handled well? Was the talk well organised and stayed within the time restriction?

Visual Aids: slides, figures and graphs  20  quality (including logical structure) of the visual aids used.

---

**MATE97043 Advanced Materials Science and Engineering Research Project – Research Project Thesis Coursework Information**

<table>
<thead>
<tr>
<th>Module:</th>
<th>MATE97043 - Advanced Materials Science and Engineering Research Project</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assessment/Coursework Name</td>
<td>Research Project Thesis</td>
</tr>
<tr>
<td>Academic in charge</td>
<td>Dr Ifan Stephens</td>
</tr>
<tr>
<td>Method of submission</td>
<td>Blackboard Learn and Turnitin</td>
</tr>
<tr>
<td>Student’s self-study hours: e.g. 10-15 hours of self-study required</td>
<td>450 hrs</td>
</tr>
<tr>
<td>Assignment details:</td>
<td>Carry out research between the summer exams and the deadline date, under the supervision of an academic, and write it up as a thesis. The thesis should answer the research question and convey the ability to develop an appropriate methodology to solve the problems posed. A high level of scientific understanding is expected. This includes an awareness of the scope and limitations of the techniques used, an ability to present and interpret results, the discussion of the results in light of the wider literature, and an understanding of the wider implications of the findings. The layout should be discussed with the supervisor, but the recommended general outline is as follows: Guidance on the Thesis Writingconciselyisa skill that you should be developing throughout the degree. It is easier to write a high quality short document than a long one, and this is easier to mark in a robust fashion. Therefore the project report is limited to 40 pages in length (excluding any appendices for the supervisor, etc) – a total</td>
</tr>
</tbody>
</table>

of 20 sides of A4, including cover sheet and references. A template (in LaTeX and MSWord) is provided and should be respected – 11pt Arial/Calibri for the main text, with 1.5cm margins, single spaced. Pages should be numbered, with the cover page being page 1. It should include

1pp Title Page and Abstract. To include project title, your name, supervisors incl PhDs and PDRAs and an abstract of up to 150 words.

1pp Contents. Do not go beyond the first subheading level. If appropriate, here include a paragraph providing commentary, on industrial involvement in the project and its relationship to any prior work, e.g. in a UROP or summer placement. A paragraph of acknowledgements and thanks should also be included here.

1pp Aims and Context. 1 paragraph on the aims of the project, and then a brief outline of the application context of the work and the relevance of the topic of study to society and industry.

15pp Literature Review.

3pp Methods.

12-17pp Results. (Bear in mind that around 1/3rd of this might be figures)

3-5pp Discussion.

0.5pp Conclusions

1-2.5pp References. Around 60 references would be normal.

You may include additional material as an appendix, but this will not be marked.

Further guidance is provided in the templates provided and the marking rubrics. To be clear: the 40 page limit is a hard limit. Many students can do a good job in fewer pages; markers are interested in the quality of the content, not in volume.

Other requirements (if applicable):

• An electronic copy should be submitted through Blackboard Learn for marking.
MATE97043 Advanced Materials Science and Engineering Research Project – Research Project Thesis Rubric:

<table>
<thead>
<tr>
<th>Item name/number</th>
<th>Value</th>
<th>Description of marking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aims and Motivation</td>
<td>5</td>
<td>Technological motivation for the work (socio-economic, technical and industrial), scientific context and clear articulation of the aims of the work and the research problem / question/ hypothesis.</td>
</tr>
<tr>
<td>Literature Review</td>
<td>25</td>
<td>The review should aim to identify what has been done in the research area, what knowledge gaps remain that might profitably be explored in the project and include a summary. Students are guided to avoid reworking standard textbooks and review articles and instead to synthesize the primary literature; copying and pasting of (appropriately referenced) figures is acceptable but should receive nil credit.</td>
</tr>
<tr>
<td>Results and Analysis</td>
<td>30</td>
<td>Copious results coherently presented and related to each other with the inferences drawn from different approaches discussed and contrasted. Methods and their limitations clearly well understood.</td>
</tr>
<tr>
<td>Discussion, Conclusions and Abstract</td>
<td>20</td>
<td>There is no requirement to separate the discussion from the results into separate sections. Whichever approach is taken, the learning outcomes being tested are the ability to interpret the results in the context of the literature and technological problem investigated, to draw appropriate conclusions (&lt;1pp) and to summarise and extract the main findings in a coherent abstract (200 words).</td>
</tr>
<tr>
<td>Written Presentation, presentation of (original) figures and handing of data</td>
<td>20</td>
<td>Logical structure and overall presentation, correct English and grammar, quality of referencing (completeness and in a consistent and recognisable style). Overall effectiveness of the Thesis as a technical document. Bear in mind that a template is provided. At the upper end (8+/10) textbook/publication quality would be expected. At the lower end of the scale (0-5) significant problems of English and style remain. Figures and Tables should meet scientific norms around error bars, units and axes, appropriateness of trend and fit lines, appropriate use of precision e.g. in tables, scale bars and relationship to sample axes, consideration of symmetry and crystallography. Captions should be descriptive and helpful to the reader. Use of colour should be appropriate and the presentation of data in graphs e.g. when compared to the literature or using multiple axes should aid clarity and insight. Again, a mark of 8+/10 would indicate uniformly publication-quality figures in leading journals.</td>
</tr>
</tbody>
</table>

• An electronic copy should be submitted through TurnItIn for a plagiarism check.
# Appendix B - Academic Staff List

<table>
<thead>
<tr>
<th>Head of Department</th>
<th>Name</th>
<th>Initials</th>
<th>Room</th>
<th>Email</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prof Peter Haynes</td>
<td>PDH</td>
<td>2.01b</td>
<td></td>
<td><a href="mailto:p.haynes@imperial.ac.uk">p.haynes@imperial.ac.uk</a></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Academic Staff</th>
<th>Name</th>
<th>Initials</th>
<th>Room</th>
<th>Email</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dr Aina Aguadero</td>
<td>AA</td>
<td>1.07</td>
<td></td>
<td><a href="mailto:a.aguadero@imperial.ac.uk">a.aguadero@imperial.ac.uk</a></td>
</tr>
<tr>
<td>Prof Neil Alford</td>
<td>NMA</td>
<td>2.05</td>
<td></td>
<td><a href="mailto:n.alford@imperial.ac.uk">n.alford@imperial.ac.uk</a></td>
</tr>
<tr>
<td>Dr Stefano Angioletti-Uberti</td>
<td>SAU</td>
<td>1.08</td>
<td></td>
<td><a href="mailto:s.angioletti-uberti07@imperial.ac.uk">s.angioletti-uberti07@imperial.ac.uk</a></td>
</tr>
<tr>
<td>Dr Florian Bouville</td>
<td>FB</td>
<td>LM04a</td>
<td></td>
<td><a href="mailto:f.bouville@imperial.ac.uk">f.bouville@imperial.ac.uk</a></td>
</tr>
<tr>
<td>Dr Ben Britton</td>
<td>BB</td>
<td>B301E</td>
<td></td>
<td><a href="mailto:b.britton@imperial.ac.uk">b.britton@imperial.ac.uk</a></td>
</tr>
<tr>
<td>Dr Andrew Cairns</td>
<td>AC</td>
<td>2.03D</td>
<td></td>
<td><a href="mailto:a.cairns@imperial.ac.uk">a.cairns@imperial.ac.uk</a></td>
</tr>
<tr>
<td>Dr Iain Dunlop</td>
<td>ID</td>
<td>1.02</td>
<td></td>
<td><a href="mailto:i.dunlop@imperial.ac.uk">i.dunlop@imperial.ac.uk</a></td>
</tr>
<tr>
<td>Prof Fionn Dunne</td>
<td>FD</td>
<td>1.04</td>
<td></td>
<td><a href="mailto:fionn.dunne@imperial.ac.uk">fionn.dunne@imperial.ac.uk</a></td>
</tr>
<tr>
<td>Prof David Dye</td>
<td>DD</td>
<td>1.09</td>
<td></td>
<td><a href="mailto:david.dye@imperial.ac.uk">david.dye@imperial.ac.uk</a></td>
</tr>
<tr>
<td>Prof Mike Finnis</td>
<td>MWF</td>
<td>2.27b</td>
<td></td>
<td><a href="mailto:m.finnis@imperial.ac.uk">m.finnis@imperial.ac.uk</a></td>
</tr>
<tr>
<td>Dr Paul Franklyn</td>
<td>PF</td>
<td>G.03B</td>
<td></td>
<td><a href="mailto:p.franklyn@imperial.ac.uk">p.franklyn@imperial.ac.uk</a></td>
</tr>
<tr>
<td>Name</td>
<td>Initials</td>
<td>Room</td>
<td>Email</td>
<td></td>
</tr>
<tr>
<td>------------------------------</td>
<td>----------</td>
<td>-------</td>
<td>--------------------------------------</td>
<td></td>
</tr>
<tr>
<td>Dr Baptiste Gault</td>
<td>BG</td>
<td></td>
<td><a href="mailto:b.gault@imperial.ac.uk">b.gault@imperial.ac.uk</a></td>
<td></td>
</tr>
<tr>
<td>Dr Theoni Georgiou</td>
<td>TG</td>
<td>1.05</td>
<td><a href="mailto:t.georgiou@imperial.ac.uk">t.georgiou@imperial.ac.uk</a></td>
<td></td>
</tr>
<tr>
<td>Dr Finn Giuliani</td>
<td>FG</td>
<td>LM04D</td>
<td><a href="mailto:f.giuliani@imperial.ac.uk">f.giuliani@imperial.ac.uk</a></td>
<td></td>
</tr>
<tr>
<td>Prof Christopher Gourlay</td>
<td>CG</td>
<td>B301D</td>
<td><a href="mailto:c.gourlay@imperial.ac.uk">c.gourlay@imperial.ac.uk</a></td>
<td></td>
</tr>
<tr>
<td>Prof Robin Grimes</td>
<td>RWG</td>
<td>B301C</td>
<td><a href="mailto:r.grimes@imperial.ac.uk">r.grimes@imperial.ac.uk</a></td>
<td></td>
</tr>
<tr>
<td>Prof Sandrine Heutz</td>
<td>SH</td>
<td>B336</td>
<td><a href="mailto:s.heutz@imperial.ac.uk">s.heutz@imperial.ac.uk</a></td>
<td></td>
</tr>
<tr>
<td>Prof Andrew Horsfield</td>
<td>APH</td>
<td>B331</td>
<td><a href="mailto:a.horsfield@imperial.ac.uk">a.horsfield@imperial.ac.uk</a></td>
<td></td>
</tr>
<tr>
<td>Dr Robert Hoye</td>
<td>RH</td>
<td>2.27</td>
<td><a href="mailto:r.hoye@imperial.ac.uk">r.hoye@imperial.ac.uk</a></td>
<td></td>
</tr>
<tr>
<td>Prof Julian Jones</td>
<td>JRJ</td>
<td>2.07</td>
<td><a href="mailto:julian.r.jones@imperial.ac.uk">julian.r.jones@imperial.ac.uk</a></td>
<td></td>
</tr>
<tr>
<td>Prof John Kilner</td>
<td>JAK</td>
<td>2.14</td>
<td><a href="mailto:j.kilner@imperial.ac.uk">j.kilner@imperial.ac.uk</a></td>
<td></td>
</tr>
<tr>
<td>Prof Norbert Klein</td>
<td>NK</td>
<td>2.01c</td>
<td><a href="mailto:n.klein@imperial.ac.uk">n.klein@imperial.ac.uk</a></td>
<td></td>
</tr>
<tr>
<td>Dr Johannes Lischner</td>
<td>JL</td>
<td>B342</td>
<td><a href="mailto:j.lischner@imperial.ac.uk">j.lischner@imperial.ac.uk</a></td>
<td></td>
</tr>
<tr>
<td>Dr Katharina Marquardt</td>
<td>KM</td>
<td>301b</td>
<td><a href="mailto:k.marquardt@imperial.ac.uk">k.marquardt@imperial.ac.uk</a></td>
<td></td>
</tr>
<tr>
<td>Dr Cecilia Mattevi</td>
<td>CM</td>
<td>2.11</td>
<td><a href="mailto:c.mattevi@imperial.ac.uk">c.mattevi@imperial.ac.uk</a></td>
<td></td>
</tr>
<tr>
<td>Prof Martyn McLachlan</td>
<td>MAM</td>
<td>G.03c</td>
<td><a href="mailto:martyn.mclachlan@imperial.ac.uk">martyn.mclachlan@imperial.ac.uk</a></td>
<td></td>
</tr>
<tr>
<td>Prof Arash Mostofi</td>
<td>AAM</td>
<td>B332</td>
<td><a href="mailto:a.mostofi@imperial.ac.uk">a.mostofi@imperial.ac.uk</a></td>
<td></td>
</tr>
<tr>
<td>Dr Mark Oxborrow</td>
<td>MO</td>
<td>2.04</td>
<td><a href="mailto:m.oxborrow@imperial.ac.uk">m.oxborrow@imperial.ac.uk</a></td>
<td></td>
</tr>
<tr>
<td>Prof David Payne</td>
<td>DP</td>
<td>2.09</td>
<td><a href="mailto:d.payne@imperial.ac.uk">d.payne@imperial.ac.uk</a></td>
<td></td>
</tr>
<tr>
<td>Dr Stella Pedrazzini</td>
<td>SP</td>
<td>1.18</td>
<td><a href="mailto:s.pedrazzini@imperial.ac.uk">s.pedrazzini@imperial.ac.uk</a></td>
<td></td>
</tr>
<tr>
<td>Dr Minh-Son Pham</td>
<td>M-SP</td>
<td>301F</td>
<td><a href="mailto:son.pham@imperial.ac.uk">son.pham@imperial.ac.uk</a></td>
<td></td>
</tr>
<tr>
<td>Prof Alexandra Porter</td>
<td>AEP</td>
<td>B341</td>
<td><a href="mailto:a.porter@imperial.ac.uk">a.porter@imperial.ac.uk</a></td>
<td></td>
</tr>
<tr>
<td>Prof Jason Riley</td>
<td>DJR</td>
<td>B337</td>
<td><a href="mailto:jason.riley@imperial.ac.uk">jason.riley@imperial.ac.uk</a></td>
<td></td>
</tr>
<tr>
<td>Prof Mary Ryan</td>
<td>MPR</td>
<td>B338</td>
<td><a href="mailto:m.p.ryan@imperial.ac.uk">m.p.ryan@imperial.ac.uk</a></td>
<td></td>
</tr>
<tr>
<td>Prof Eduardo Saiz Gutierrez</td>
<td>ES</td>
<td>LM04.B</td>
<td><a href="mailto:e.saiz@imperial.ac.uk">e.saiz@imperial.ac.uk</a></td>
<td></td>
</tr>
<tr>
<td>Prof Milo Shaffer</td>
<td>MS</td>
<td>M221</td>
<td><a href="mailto:m.shaffer@imperial.ac.uk">m.shaffer@imperial.ac.uk</a></td>
<td></td>
</tr>
<tr>
<td>Dr Manjula Silva</td>
<td>MS</td>
<td>G04</td>
<td><a href="mailto:k.silva@imperial.ac.uk">k.silva@imperial.ac.uk</a></td>
<td></td>
</tr>
<tr>
<td>Prof Stephen Skinner</td>
<td>SJS</td>
<td>2.06</td>
<td><a href="mailto:s.skinner@imperial.ac.uk">s.skinner@imperial.ac.uk</a></td>
<td></td>
</tr>
<tr>
<td>Dr Ifan Stephens</td>
<td>IS</td>
<td>2.03B</td>
<td><a href="mailto:i.stephens@imperial.ac.uk">i.stephens@imperial.ac.uk</a></td>
<td></td>
</tr>
<tr>
<td>Prof Molly Stevens</td>
<td>MMS</td>
<td>2.08</td>
<td><a href="mailto:m.stevens@imperial.ac.uk">m.stevens@imperial.ac.uk</a></td>
<td></td>
</tr>
<tr>
<td>Prof Natalie Stingelin</td>
<td>NS</td>
<td>1.08</td>
<td><a href="mailto:n.stingelin-stutzmann@imperial.ac.uk">n.stingelin-stutzmann@imperial.ac.uk</a></td>
<td></td>
</tr>
<tr>
<td>Dr Paul Tangney</td>
<td>PT</td>
<td>B330</td>
<td><a href="mailto:p.tangney@imperial.ac.uk">p.tangney@imperial.ac.uk</a></td>
<td></td>
</tr>
<tr>
<td>Prof Luc Vandeperre</td>
<td>LV</td>
<td>LM.04C</td>
<td><a href="mailto:l.vandeperre@imperial.ac.uk">l.vandeperre@imperial.ac.uk</a></td>
<td></td>
</tr>
<tr>
<td>Prof Aron Walsh</td>
<td>AW</td>
<td>2.10</td>
<td><a href="mailto:a.walsh@imperial.ac.uk">a.walsh@imperial.ac.uk</a></td>
<td></td>
</tr>
<tr>
<td>Dr Mark Wenman</td>
<td>MW</td>
<td>B301A</td>
<td><a href="mailto:m.wenman@imperial.ac.uk">m.wenman@imperial.ac.uk</a></td>
<td></td>
</tr>
<tr>
<td>Dr Fang Xie</td>
<td>FX</td>
<td>1.03</td>
<td><a href="mailto:f.xie@imperial.ac.uk">f.xie@imperial.ac.uk</a></td>
<td></td>
</tr>
</tbody>
</table>

**Teaching Fellows**
Appendix C - Research Integrity

Research integrity is about your research practices, how you present the findings of your research and how your research impacts on society and the wider world. At Imperial College London, you will work with internationally renowned academic staff who will guide you to design rigorous, robust, and reproducible research methods. This will ensure that your research is lawful and that any adverse impact your research may have on society, natural environment, or animals is justified and minimised. Research integrity is also about presenting the findings of your research in a responsible manner.

The College has adopted the Council for Science and Technology's Universal Ethical Code for Scientists and upholds its three principles, which are:

- Rigour, Honesty and Integrity
- Respect for Life, the Law and the Public Good
- Responsible Communications: Listening and Informing

The primary way to ensure research integrity is to promote and maintain a culture of honesty, openness and responsibility. To this end, the Graduate School has the following professional development opportunities available to postgraduate students:

- Plagiarism Awareness, mandatory for both Master’s and Doctoral students

This online course was developed by the Graduate School, in conjunction with the Library. It aims to equip you with a working knowledge of the concept of plagiarism and how to avoid it. It also aims to provide you with information to enable you to use and share
information ethically, with academic integrity and in accordance with Imperial College’s Examination & Assessment: Academic Integrity Policy.

• Copyright for Researchers (Doctoral)

This course aims to equip you with a working knowledge of copyright and licencing so that in your career you can use and share information in a copyright safe way. The course has activities and discussions to give you the opportunity to practice the knowledge and skills acquired through context-based scenarios and examples. You are recommended to share your reflections on the digital canvases throughout the course. This will give you a chance to elaborate what you have learnt in the readings, share examples and challenge your understanding by interacting with your peers.

• Intellectual Property (Doctoral)

This course aims to equip you with a working knowledge of the concept of Intellectual Property (IP), and an awareness and understanding of the basic principles surrounding IP rights, such as patents, copyright, design rights and other forms of IP. An understanding of IP and its application is important for all students; for those intending to continue in academia as well as those intending to enter the commercial world after graduation.

• Introduction to Making your Thesis Open Access (Doctoral)

This workshop will provide a general introduction to open access, with specific reference to the PhD thesis, and related research outputs that may arise from PhD study. You will be introduced to: open access repositories, open access publishing and online support tools such as the Directory of Open Access Journals and Open access button. You will also be provided with the opportunity to discuss Creative Commons licences, the re-use of third-party copyright materials in your thesis and why your thesis is made open access.

• Data Management (Doctoral)

Data is a key research asset, underpinning almost all published research conclusions. In recent years, new technology has enabled us to:

1. Generate and record far more data than ever before; and
2. Share, reuse and combine that data in new ways to generate new insights.

Research data is increasingly a first-class research output, and a little bit of planning will enable you to take advantage of this shift. This course will highlight key considerations and help you to assess when it is appropriate to share your data and how to write a data management plan.

This workshop is supported by a webinar on Research Data Management Plans which covers some of the more practical elements of research data management and will help students to create their own data management plans.

• Science, Research and Integrity (Doctoral)

This workshop is designed to give you a chance to explore and critically analyse the ethics of scientific research in a constructive way. We will critically discuss the structure and implications of specific cases of scientific fraud and will also look at different moral theories and how they might apply not only to specific moral dilemmas, but also to science in general. The session will aim to forearm you by providing a safe environment within which to formulate and articulate your own views on how you might deal with the sorts of dilemmas you are likely to face during your career.

The San Francisco Declaration on Research Assessment (DORA)
The College has signed the San Francisco Declaration on Research Assessment (DORA). The ethos behind DORA is to improve the ways in which the output of scientific research is evaluated by funding agencies, academic institutions, and other parties. The outputs from scientific research are many and varied, including: research articles reporting new knowledge, data, reagents, and software; intellectual property; and highly trained young scientists. Funding agencies, institutions that employ scientists, and scientists themselves, all have a desire, and need, to assess the quality and impact of scientific outputs. It is thus imperative that scientific output is measured accurately and evaluated wisely.

As such the College has signalled that it will assess research based on quality rather than where it is published, for example journal impact factor. The Graduate School promotes the ethos behind DORA at the following professional development workshops:

- Writing for publication
- How to be an effective researcher
- Global Research Impact and Influence retreat
- Finish Up Move On
- Impact in academia webinars
- Understanding the reviewer

References:

The San Francisco Declaration on Research Assessment [DORA] [accessed 26.06.20]
The UK Concordat to Support Research Integrity – Universities UK [accessed 26.06.20]
The Universal Ethical Code for Scientists [accessed 26.06.20]
The European Code of Conduct for Research Integrity – ALLEA (All European Academies) [accessed 20.06.20]