The Department of Bioengineering Undergraduate INDIVIDUAL PROJECT Handbook

Year 4 MEng individual project

CONTENTS

OVERVIEW OF THE MEng PROJECTS

Research projects are an important part of the Bioengineering degree course. Projects give students an opportunity to apply the knowledge learned in the rest of the course to current research problems. They also help to develop important project management, team working, organisation, and communication skills that are highly valued by employers and international research groups.

The learning outcomes for the MEng individual projects are that at the end of this module you will be able to:

- Appraise the scientific and engineering literature and relate this to a Bioengineering research question
- Plan, implement and revise a structured project plan to reach a defined research goal taking into account ethical, sustainability and data security issues.
- Demonstrate organisational and time management skills.
- Evaluate the effectiveness of a proposed solution to a research question
- Demonstrate advanced skills in lab work, design, computational modelling, and programming, as required for your project.
- Produce journal style written reports and oral presentations to succinctly communicate your results to both peers and non-experts
- Engage in open-ended and multi-disciplinary investigation

Projects are carried out under the direction and guidance of members of the academic staff and their research groups. They are important pieces of work in the degree programme. They provide the opportunity for you to demonstrate independence and originality, to plan and organise a large project over a long period, and to put into practice your learning throughout the course. Whatever your level of academic achievement so far, you can show your individuality and inspiration in this project. It could be the most satisfying piece of work in your degree.

More details about projects can be found here:
http://www.imperial.ac.uk/bioengineering/admin/current-ug/projects/

Projects that require Ethics approval

Ethics approval is needed for **any research that involves human participants; their tissue and /or data** to ensure that the dignity, rights, safety and well-being of all participants are the primary consideration of the research project. Information on the process of approval can be found here: Ethics approval overview | Research | Imperial College London If you believe your project will need ethics approval discuss this early with your supervisor.

Recording ethical implications in the report

Reports and theses need to have a statement, saying that (when appropriate to the project):

- The project has been approved by the Imperial College Ethics Committee, including the approval number.
- The patients/participants gave consent to use their data.

Your planning report also needs to contain a section on ethics, sustainability and data security. Further detail is given in the planning report section.

Key contacts

The Project Co-ordinator: Prof. Julien Vermot (bg-studentprojects@imperial.ac.uk). Please note that project-related inquiries sent to any other email (e.g. Prof Vermot's imperial email) WILL NOT be processed. We will aim to resolve your issue in 5 working days in normal circumstances.

Admin support: Mr Martin Holloway (RSM 3.08) and Ms Nicole Harbert (Student Office RSM 3.21c)

BME MENG INDIVIDUAL PROJECT

Work on project

Project work may start from the first week of term, subject to agreement and safety forms having been submitted**.** The exact amount of time spent on projects is not fixed, but is on the order of 40- 60 days full time equivalent.

- Autumn term: work will be part-time. You will be expected to work at least 8 hours each week - the precise choice of timeslots being determined by your option courses.
- Spring term: work will continue to be part time, working at least 6-8 hours each week.
- Summer term: work is full time after the summer exams and until the final report submission.

To monitor progress and your effort on the project you will keep a Project Log Book (manual or electronic) that will be seen by your supervisor at regular intervals and handed in to them **BEFORE** the oral presentation.

Assessment

As the project is an important part of your degree, it is assessed by several routes. Each task is described later in this booklet. Your project is worth 50% of your final year marks.

Mode of assessment	% final marks	Deadline
Interim presentation	-	in Jan 2026
Planning report	10	9 Jan 2026 at 3pm
Oral presentation (Research Day)	20	18 June 2026
Final report	70	11 June 2025 at 3pm

All reports are submitted in pdf format on Blackboard: https://bb.imperial.ac.uk by the announced deadline. Failure to meet this deadline will result in penalties being applied in line with the university's late submission policy. Hard copies are only needed if the supervisor requests one.

The planning report is marked by your supervisor only. The final report is marked by your supervisor and another approved marker. The overall mark for the final report is a combination of the written report mark weighted at 80%, and a mark for professional conduct given by your supervisor and weighted at 20%. Oral presentations will be assessed on the Departmental Project Presentation Day, by two or more approved markers. You must attend this day and present in person. A prize will be awarded for the best talk. Further details on the assessment criteria are given in Appendix 2.

MBE MENG INDIVIDUAL PROJECT

Work on project

Project work may start on the first week of the Spring term subject to agreement and safety forms having been submitted**.** The exact amount of time spent on projects is not fixed, but is on the order of 60-90 days full time equivalent. Your project is worth 58.3% of your final year marks.

- Autumn term: Although you will have been assigned a project and a project supervisor, your project will only start in the Spring term and the Autumn term should be dedicated to completing your elective modules. You are invited, however, to start familiarizing yourself with the relevant literature, complete lab inductions etc. This should be discussed with your project supervisor.
- Spring term: Full term will be dedicated to your project (30-35 hours per week).
- Summer term: Work is full time after the summer exams and until the final report submission.

To monitor progress and your effort on the project you will keep a Project Log Book (manual or electronic) that will be seen by your supervisor at regular intervals and handed in to them **BEFORE** the oral presentation.

Assessment

As the project is an important part of your degree, it is assessed by several routes. Each task is described later in this booklet.

Mode of assessment	% final marks	Deadline
Interim presentation	-	by 16 Feb 2026
Planning report	10	19 Feb 2026 at 3pm
Oral presentation (Research Day)	20	18 June 2026
Final report	70	11 June 2026 at 3pm

All reports are submitted in pdf format on Blackboard: https://bb.imperial.ac.uk by the announced deadline. Failure to meet this deadline will result in penalties being applied in line with the university's late submission policy. Hard copies are only needed if the supervisor requests one.

The planning report is marked by your supervisor only. The final report is marked by your supervisor and another approved marker. The overall mark for the final report is a combination of the written report mark weighted at 80%, and a mark for professional conduct given by your supervisor and weighted at 20%. Oral presentations will be assessed on the Departmental Project Presentation Day, by two or more approved markers. You must attend this day and present in person. A prize will be awarded for the best talk. Further details on the assessment criteria are given in Appendix 2.

PROJECT ASSESSMENT

It is important to understand the way your project will be assessed. A good first-class project involves a combination of sound background research, a solid implementation or piece of theoretical work, and a well-structured and well-presented report detailing the project's background, objectives and achievements. The very best projects invariably cover some new ground, e.g., by developing a system which does not already exist or by enhancing some existing system, application or method to improve its functionality, performance etc.

A completely straightforward implementation project is unlikely to gain first-class marks, regardless of how well it is done. Similarly, projects which are predominantly survey reports will not gain high marks unless they are backed up with experimentation, implementation, or theoretical analysis, e.g., for performing an objective comparison of the surveyed methods, techniques etc.

If you are looking to achieve high marks in your project and, particularly, if you are hoping to win one of the illustrious project prizes, you should choose and carry out your project with great care. Remember also that your attitude to, and performance in, the individual project is taken very seriously by prospective employers and your progress is usually reported in some detail in academic references provided for you by staff members. Don't be afraid to discuss these issues with your supervisor, or with the project co-ordinator.

Preliminary presentation

You are required to give a short (5-10 min) presentation to your supervisor and your supervisor's research group some time at the start or middle of the Spring term. This presentation will include details of your progress on the project, and of the results that you have obtained so far. The objectives of this presentation are (a) to practice presenting / communicating your work, and (b) to receive feedback on your progress by your supervisor and their research group. The presentation is formative and contributes no marks to the project.

Planning report

You are required to prepare a planning report for submission in January for BME, and February for MBE. A template to base it on will appear on blackboard in good time. The planning report should not exceed 4000 words. This number is a limit, not a target. Title page, table of contents, abstract, acknowledgements, tables, figures, appendices, captions (though they should not be used for content not present in the main text), abbreviation list and bibliography will not count towards the word limit (but everything else does). You should not devote weeks to writing the report. The aim of the report is to summarise the background to your project, what you achieved so far, what your plan is and how you will manage any ethical, sustainability and data security issues. Your report should contain the following sections.

Project Specification

This section should state clearly what the project is intended to deliver. It should contain the aims and objectives / hypotheses of your work.

Background

To include a literature review that summarises the key findings from a range of published sources that you have used to identify research gaps, shape your aims and objectives, and justify the decisions you are making in your methodology. The text should be clear, with use of figures (with attribution) if helpful to the explanation. This literature review section is formative and will not contribute towards the mark for the planning report. It is expected that you will develop this section for resubmission in the final report based on feedback and discussion with your supervisor.

Implementation Plan

This is a breakdown of the work done already and of the work to be done in the time remaining on the project. This could be presented in text or diagrammatic form. You should identify a set of milestones and provide a realistic estimate of when each of these should be completed if all goes well. It should also detail fall-back positions in case any stage of the development goes wrong. You may feel, in the early stages of your project work, that the times in this plan are guesses. As the project progresses, keeping track of and revising appropriately your initial estimates, but also if necessary, altering the proposed work, is a vital way to ensure that the project is successfully finished on time and on budget.

Risk Register

This is a short section. Identify the main risks associated with achieving your objectives and deliverables, label them in terms of likelihood and impact, and detail your mitigation strategy.

Ethical, Sustainability and Data Security Analysis

This section should consider the wider context of your project and the ethical, sustainability and data security requirements. Areas you may wish to cover include:

> **Ethics:** you should show that you've thought carefully about the broader impacts, responsibilities, and possible risks of your project. This may include discussion of who benefits from the project and if there equally opportunity for all to benefit from the project, or how it could promotes fairness and inclusion. How will you demonstrate honesty and integrity in data collection, analysis and reporting? Is there any potential harm to users or the public, and how is this justified? Are there any legal or regulatory requirements related to the project?
>
> **Sustainability:** Consider the three Ps, people, planet and profit. What resources does your project need, and what waste will you produce? How can you minimize this? What is the lifecycle impact of your project? How will it be disposed of or maintained when you finish? Is your project cost-effective? How can it be more efficient? What are the impacts on people?

Data security: How will you collect data? How will you store data? Who will be able to access the data? How will you share data at the end of your project? If you hold collect any sensitive information such as personal data you should show how you are compliant with the Data Protection Act. Further guidance on this can be found here: Data protection guidance | Administration and support services | Imperial College London

Some of these areas may be more significant than others for your project but you should address all three aspects. In years 1 and 2 you have been introduced to ethical analysis and sustainability frameworks as part of the design and professional practice modules, and it is advised that you review this material to help with this section of the report.

Evaluation

Detail how you expect to measure the success of the project. In particular, document any tests (physical, computational, theoretical) that are required to ensure that the project deliverable(s) function correctly, together with - where appropriate - details of experiments required to evaluate the work with respect to other products or research results.

Preliminary Results

Give details of the progress you have made in the project up to now. Remember it is a short report; you should not provide long technical descriptions here; the place for that is in your final report.

List all sources you referenced in your report giving full details appropriately so that the reader can access each source. Information on appropriate referencing can be found in the library webpages. It is strongly advised to use a reference manager such as Mendeley; it will save you a lot of time when preparing planning and final reports as it can produce the bibliography automatically for you using the style of your liking.

Final report

The project report is an extremely important aspect of the project and its quality will have a major influence on the final project mark. It serves to show what you have achieved and should demonstrate that:

- you understand the wider context of biomedical engineering;
- you can apply the theoretical and practical techniques you have been taught to the problems that you are addressing;
- you are capable of objectively criticising your own work, placing it in comparison with published literature, and making constructive suggestions for improvement or further work based on your experiences so far;
- as a professional bioengineer, you can document clearly and concisely your thinking and working processes for third parties who may not be experts in the field in which you are working;
- you can express this information in a concise manner;

Except for the project supervisor, the report assessors will not have followed your project throughout and for this reason will rely heavily on the report to judge the quality of your work. The same applies to the external examiners whose job it is to provide an opinion, heavily influenced by the individual project, to the exam board on borderline candidates.

Do not underestimate the importance of the report and make the mistake of thinking that top marks can be achieved simply for working hard producing a good product. This is fundamentally not the case and many projects have been graded well below their potential because of an indifferent or poor write-up. To get the balance right, you should consider that the aim of the project is to produce a good report, and that software, hardware, theory etc. that you developed during the project are

merely a means to this end. Don't make the mistake of leaving the write-up to the last minute. Ideally you should produce the bulk of the report as you go along and use the last week or two to bring it together into a coherent document.

The physical layout and formatting of the report is also important, and yet is very often neglected. A tidy, well laid out and consistently formatted document makes for easier reading and is suggestive of a careful and professional attitude towards its preparation.

You will be given a template on blackboard in good time to base your report on. The report should not exceed 6000 words. This number is a limit, not a target. Reports that do not comply with this guideline are unlikely to be given a mark of more than 59% (see assessment criteria at the end of this handbook). Title page, table of contents, abstract, acknowledgements, tables and figures, appendices, captions (though they should not be used for content that is not present in the main text), abbreviation list and bibliography will not count towards the word limit (but everything else does). Extra material can be appended to the report to allow you to disseminate all the necessary information to someone who might want to repeat your work or pick up the project details at a later stage. The appendix will not be specifically marked, but it is appropriate use to disseminate all information will be judged by the assessors. See the next page for examples of the sort of content that would go in the appendix.

Generative AI guidance

You may use generative AI in an **assistive capacity** when preparing your planning and final reports. This might be to review language, help identify ethical or sustainability issues, help with report structure, help search literature, polish technical methods in simpler terms, or suggest ways to present results.

If you do make use of generative AI tools you must ensure you acknowledge this appropriately and do not present content created by generative AI tools as though it were your own work. Guidance on acknowledging and referencing generative AI tools can be found here: Generative AI guidance | Administration and support services | Imperial College London You should also save copies of any outputs from genAI tools used to support your work, as these may be requested as part of the assessment or in any academic misconduct process.

A typical technical or research report will have the following sections, however, the work for some projects might be better disseminated with a different layout.

1. Introduction
2. Methods
3. Results
4. Discussion

Abstract

Include all of background, aim, method, results, and discussion/conclusion. Could be one sentence each. As you see fit. It should be written for a general audience. Up to 250 words.

Acknowledgements

This section is not required. It is, however, usual to thank those individuals who have provided particularly useful assistance, technical or otherwise, during your project.

Introduction

To include a literature review that summarises the key findings from a range of published sources that you have used to identify research gaps, shape your aims and objectives, and justify the decisions you are making in your methodology. The text should be clear, with use of figures (with attribution) if helpful to the explanation.

Include a clear aim (and maybe specific objectives) and / or your hypotheses at the end of the introduction. For example, the overall aim was to do this and specific objectives were to do 1, 2, and 3. Your intro should lead to the aim: This is a problem. Something was done in the past (literature review), but not as well / enough (i.e. be critical). Therefore I am going to do something better /different $\rightarrow$ aim.
Of note, only the literature review can be used verbatim from the planning report as this was not previously submitted for marks. Everything else transposed from the planning report to the final report will be considered as self-plagiarism.

Methods

This section should outline the methods used with sufficient detail that others would be able to reproduce what you did. As always, don't include unnecessary or repeated information. You should justify every decision you make or technique you use.

Results

This section should be an objective presentation of your findings. You can tell us what your results mean in the discussion. Think carefully how you present your results so that you put the intended point across to your readers. This will perhaps require tables, graphs and figures to communicate your findings effectively.

Discussion

This is where you conduct an objective evaluation of the project's successes and failures and compare it to existing literature. It is important to understand that there is no such thing as a perfect project. Even the very best pieces of work have their limitations and you are expected to provide a proper critical appraisal of what you have done. Your assessors are bound to spot the limitations of your work and you are expected to be able to do the same.

Start with a quick summary of what you've done and found, i.e. 1-2 sentences, then discuss them. What do your results mean? Derive conclusions off them, but make sure they are justified. Use expressions such as 'it is likely', 'this suggests that' etc. Compare your results with literature. Discuss any limitations of the study. Suggest improvements and how future work could deal with the problems you encountered. Avoid words such as 'very', 'good', 'little'; talk with numbers.

Conclusion (if you want; it could be the last paragraph of the discussion instead of a separate section)

Give us the take-home message and how your design / findings could be used / explored further. It should be 1 paragraph.

References

List all sources you referenced in your report giving full details appropriately so that the reader can access each source. Information on appropriate referencing can be found in the library webpages. It is strongly advised to use a reference manager such as Mendeley; it will save you a lot of time when preparing planning and final reports as it can produce the bibliography automatically for you using the style of your liking.

Annex(es) / Appendix

Use this space for any additional information. Refer to the annex in the main text, else the reader is not going to have a reason to look at it. You could have more than one annex, as appropriate. The annexes contain information which is not essential for the 'story' to be told, but helpful to the reader that might want to dig into the detail or take your work forward. Information included here typically is program listings, user guides, complex circuit diagrams, tables, proofs, additional results, graphs or any other material which would break up the theme of the text if it appeared in the main body. Large program listings or actual files may be submitted with the report, although it is preferable either to provide them to your supervisor on a pen drive, or to cite their web path name in the report. For group projects, an Annex should include an indication of which group member worked on which parts of the project.

The oral presentation (MEng)

MEng individual project students will give a formal presentation on their project work to academic staff and their peers on the Departmental Project Presentation Day, Thursday 18th June 2026. Talks will be 10 minutes long followed by 5 minutes for questions. Timings will be strictly enforced. You will be expected to put your project in context with a brief introduction, then present your methodology, main results, and conclusions. Talks will be usually given using Microsoft Powerpoint or similar although other methods are possible. Assessment will be based on volume of work, content, organisation, visual layout, rapport, and answers to questions.

You are expected to attend the whole of the morning or afternoon session you are presenting in to support your peers.

Log Book

You will need to keep a lab book / engineer's log book. This will be submitted together to your supervisor at the end of the project. It is an important task of any engineer / researcher to document their work. Indeed, in industry, records must be kept to a very high standard as part of the GLP (good laboratory practice) or ISO 9001 accreditation of the company. In a university it is equally important as good records allow others to follow your work. For each session you go into the laboratory you should:

- describe briefly what you did, why you did it, what you found and what that tells you;
- keep a record of standard procedures, such as the composition of buffer solutions, or standard test waveforms;
- the names of computer files containing raw data and analysed results.

Good record keeping will save you many hours at the end of the project trying to remember what you did, what protocol you used where, and where that fantastic graph is or comes from. Written lab records should be brought to each meeting with the supervisor and submitted along with the final report. The supervisor should sign your log book at the end of the autumn term and at a minimum every two weeks in the spring and summer terms. It is your responsibility to obtain this signature record.

USEFUL INFORMATION

Meeting your supervisor

You must make sure that you arrange regular meetings with your supervisor. These are documented by your supervisor signing your Log book. The meetings may be brief once your project is under way but your supervisor needs to know that your work is progressing. You should inform the supervisor of your College e-mail address and any changes to it, so that they can contact you, if necessary. If you need to talk to your supervisor between meetings and cannot locate him/her in their office, send an e-mail to them to suggest a time when they will be available. When you go to see your supervisor you should have prepared a written list of points you wish to discuss. Take notes during the meeting so that you do not forget the advice you were given or the conclusions that were reached. Your Log book is the ideal place for these tasks.

Equipment

You may be required to use equipment that belong to the Department or individual research groups. Such equipment is often expensive research grade equipment and almost certainly used by either other project students or members of the research group. You do not have right of access at any time you choose, as in any research environment access to equipment has to be negotiated with other users and with your supervisor. Consequently, you need to plan experiments in advance, and assemble the resources you need to make best use of your time on equipment.

You are permitted to develop software or hardware on your own equipment, provided that you can duplicate it here in College for the demonstration day. However, you should prepare a fallback position in case your equipment misbehaves. Remember in particular that the software on some cheap home computers is not reliable. A potentially good project may be spoilt by inadequate home equipment.

Finances for projects are strictly controlled; your supervisor will give you information about what is available.

Note that there is no excuse for failing to keep adequate computer backups. If you lose your program or your data or your report because of a system failure you will simply lose marks. No extensions will be given at the end of the project for you to re-type a lost report, for example.

Ordering consumables

Your project is supported by a budget, nominally of £250 for desk projects and £350 for lab projects, that is credited at around the end of the year to your supervisor's staff account. The budget holder is your supervisor and they will approve your orders. Orders should be placed via the online form.
https://www.imperial.ac.uk/bioengineering/admin/info/ordering/

We prefer you ordering through the system because if your project can be labelled as medical research – and it nominally will – the costs will be exempt of VAT. If a supplier is not on the college system, then you might have to buy the goods yourselves and claim back; you can do that using the expense claim form E1.
https://www.imperial.ac.uk/finance/financial-services/expenses/

Pitfalls

Some of the most useful things to know about individual projects are the common pitfalls.
Why do some projects go horribly wrong? Here are some of the common causes of failure:

Starting the project too late. Get started from the start of term. The longer you leave it the harder it is to get motivated, especially when all your friends seem to be flying ahead. Do not be distracted by pressing coursework deadlines from other courses. Remember your project is worth 50% of your final year mark and it will not be possible to do enough work if you only work on the project after the exams. You should aim to have completed a substantial part of the project by the end of the spring term.

Failing to meet your supervisor regularly. If you arrange a meeting with your supervisor, turn up at the agreed time. Your supervisors are busy, internationally active academics. Arrange meetings by e-mail asking when they would be free to discuss this or that particular problem. Don't just spend a week turning up at their office at random times to find they are not there. If you are stuck for any reason and you have no meeting arranged, contact your supervisor immediately, then work on some other aspect of the project until you can be seen. If one of your supervisors is outside the Department make regular contact with the project supervisor from within the department. You gain no sympathy from anyone if you lose contact with your supervisor and produce a poor project as a result. Your supervisor will be happy to help you but they can do nothing if they are unaware that you are having trouble.

Allowing too little time for the report. You should try to produce as much of your report as you can as you go along, even though you don't know in advance its exact structure. Particularly when you make figures or graphs make them to 'publication quality' as you go along so you don't have to revisit them at the last minute. The last two weeks of the project should be dedicated to pulling together the material you have accumulated and producing a polished final product.

Failing to plan a fall-back position if the planned work is not completed on time. Try to plan your project in stages so that if things go wrong in a later stage you have a completed stage to fall back on. Agree the fall-back position with you supervisor and revisit timelines with him/her at regular intervals.

Over/Under ambition. Try to be realistic about what you can achieve in the time available. A good project requires a lot of input from you and should prove to be technically challenging

throughout. At the same time, however, it is better to do a small job well than it is to fail to do a big job at all. Your supervisor will advise you on his or her expectations of the project and this will help you to set your sights accordingly.

As important as the project is, however, do not let it interfere with your exam revision. Even though you can work on your project during revision, you should try to plan not to spend any time on your project between the end of the spring term and your last examination.

UNDERGRADUATE STUDENT PROJECT SUPERVISION GUIDE – EXPECTATIONS

Student learning and development is carried out in partnership with the lecturer/supervisor. The most common method of teaching throughout the course is through lectures, but there may also be a strong focus on online learning, independent project-based work and lab work. Expectations in the classroom may differ somewhat from expectations in the laboratory. This document is intended to provide a guide to help students and supervisors understand their mutual responsibilities in regards to research projects. The content is adapted from the ***Success Guide for Master's Students***.

Supervisors expect students to:

1. Take responsibility for your project: in the end, it is your work and your supervisors are here to help you accomplish your research objectives, but not to do the thinking for you.
2. Practice good time management: the project has to be finished in a short period of time, and you are expected to work full-time on your project after exams. Supervisors expect students to strive to accomplish good work.
3. Be prepared for frustrations and unexpected problems: check the pitfalls advice in the previous section of this manual.
4. Display initiative: ultimately, the person who drives the process and strives to understand the project is you. We expect you to be curious about your work and to think about how the work of others may have an impact on the research you are doing. As a project student, you will become a fully integrated member of your supervisor's research group, and are expected to attend lab meetings, participate in research discussions, and work as part of a team. You also are expected to attend research seminars, when they do not clash with teaching sessions in Autumn and Spring terms.
5. Learn and work on topics that are new to you, and strive to familiarise yourself with new concepts (e.g. learning to use software, techniques or tools that may be new to you).
6. Be ambitious and self-critical of your own work and results, and use these skills to be critical of results in the literature.
7. Be orderly, precise and detailed in record keeping, for example, in lab notebooks or when referencing.
8. Keep up with the literature in your field: this requires initiative, but successful research is rarely done in a vacuum. Reading can stimulate new ideas that you can take to your own research; just remember to cite the primary references that influenced your thinking and never just take ideas from others without acknowledging their contribution.
9. Look at examples of past projects and ask your supervisor for recommendations on good past projects. This is a one of the best ways of learning what your supervisor expects in the written report.

10. Provide regular reports detailing your results: you should be conscientious about keeping a laboratory notebook and regularly enter all your data into tables and spreadsheets.
11. Seek feedback when you need it.
12. Always back-up your test data and electronic files.
13. Be aware of safety at all times and follow safety procedures, especially if you are working in a laboratory.
14. Develop your professional and transferrable skills by attending the transferable skills courses and lectures provided by the Graduate School, your own Department or elsewhere in the College or external providers.

As a student you can expect your supervisor to:

1. Be supportive of you both intellectually and personally. Your supervisor essentially takes over the role of the personal tutor and will come to know you much better than your lecture instructors. Keep this in mind when it comes to asking for recommendation letters.
2. Set up a viable project and ensure that you have a clear idea of aims and objectives and an initial work-plan. Some supervisors will outline the goals and initial activities of the project, but expect you to articulate the precise aims, objectives and methods yourself. If in doubt about these expectations, ask your supervisor to discuss this with you.
3. Be available (or provide an identified substitute) to talk about research problems at relatively short notice, although, at certain times of the year, you may need to give a few days' notice.
4. Help and guide you: the help is tapered as you develop confidence in your own abilities and research skills, to enable you to learn to work more on your own and to make more of your own decisions.
5. Help develop your skills in technical writing, oral presentations, problem definition, statistical data analysis, and critical literature reviews.
6. Help enable you to write research papers that could be potentially published.
7. Provide adequate funds for your research project (there is an initial budget); the Student Office can also help with some admin around this.
8. Read and constructively comment on your project planning and final reports. This of course requires you to give your supervisor a draft of your report in good time for them to review it.
9. Recognise that your supervisor has other students and other commitments.

Together, students and supervisors are expected to:

Adhere to the College and Departmental guidelines and procedures.

APPENDIX 1 – PLAGIARISM

The College takes plagiarism very seriously and regards it a form of intellectual theft. All material taken from the literature, the internet or from the work of others must be correctly referenced with details of the source. If you are at all in doubt as to whether your actions might be plagiarism check with your supervisor or the course coordinator. Remember that the content of your work is your responsibility. Ignorance of plagiarism is not a defense. See page 2 of: http://www.imperial.ac.uk/media/imperial-college/administration-and-support-services/registry/academic-governance/public/academic-policy/Examination-and-assessments---academic-integrity.pdf

The following text provides some advice on plagiarism. You are encouraged to also visit the Library's webpages aboutplagiarism.

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

Plagiarism, which is the presentation of another person's thoughts, words or images and diagrams as though they were your own and which is a form of ***cheating****, must be avoided, with particular care in coursework, essays, reports and projects written in your own time and also in open and closed book written examinations. You are encouraged to read and criticise the work of others as much as possible, and you are expected to incorporate this into your thinking and in your coursework and assessments. But you must be sure to* ***acknowledge and identify your sources****.*

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

Where plagiarism is detected this is most usually in project work or coursework ie work that is submitted in the candidate's own time but plagiarism can also occur in closed book written examinations. Such situations can arise where candidates have been able to learn text by heart [by rote] and simply reproduce what they have learnt without attribution. Where the examination is based on technical knowledge this may be acceptable and not regarded as plagiarism. In other subjects where candidates are asked to write essays the examiners may regard text reproduced without reference or critical analysis as plagiarism. Boards of Examiners are encouraged to clarify where appropriate in examination rubrics how sources should be acknowledged in those examinations.

The direct and unacknowledged repetition of your own work which has already been submitted for assessment can constitute ***self-plagiarism****.*

Where group work is submitted, this should be presented and referenced, with individual contributions recorded, in the convention appropriate to your discipline. You should therefore consult your personal or senior tutor or course director if you are in any doubt about what is permissible. You should be aware that you have a collective professional responsibility as a group for the integrity of all of the work submitted for assessment by that group. If you become aware that a

member or members of the group may have plagiarised part of the group's submission you have an obligation to report your suspicions to your personal or senior tutor or the course director.

The ***use of the work of another student****, past or present, also constitutes plagiarism. Where work is used without the consent of that student, this will normally be regarded as a major offence of plagiarism. Giving your work to another student to use (other than in a group assessment) may also constitute an offence.*

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

The College will investigate all instances where an examination or assessment offence is reported and apply appropriate penalties to students who are found guilty. These penalties include a mark of zero for the assessment in which the examination offence occurred or a mark of zero for all the assessments in that year or exclusion from all future examinations of the University (i.e. expulsion from the university)."

Types of plagiarism are explained here:

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

APPENDIX 2 –DEGREE CLASSES AND ASSESSMENT CRITERIA

Assessment criteria for professional conduct

The mark for professional conduct accounts for 20% of the final report overall marks and is awarded solely by your supervisor.

Grade	Mark Range	Effort / Quantity of Work
A*	85-100	Outstanding level of commitment and project ownership. Highly self-motivated with a consistent presence in and interaction with research group. Substantial amount of independent development and work on the project. Outstanding level of management and organizational skill, reliability, and punctuality. Outstanding ability to take initiative and propose constructive ideas. The candidate is polite and displayed an exemplary behaviour with supervisor's research group and within the lab.
A	70-84	Excellent level of effort fully satisfying expectations in handbook. Self-motivated with a consistent presence in the research group, only requiring occasional need for help with directions. Excellent level of management and organizational skill, reliability, and punctuality. Good ability to take initiative and propose constructive ideas. The candidate is polite and displayed an exemplary behaviour with supervisor's research group and within the lab.
B	60-69	Strong level of effort that meets nearly all expectations in handbook. Motivated when provided with occasional encouragement and advice. A common presence in the research group. Evidence of management and organizational skill, reliability, and punctuality. Good ability to take initiative and propose constructive ideas. The candidate is polite and displayed an exemplary behaviour with supervisor's research group and within the lab.
C	50-59	Modest level of effort that achieves some expectations in handbook. Motivated when provided with regular encouragement and advice. The candidate is polite and displayed an exemplary behaviour with supervisor's research group and within the lab.
D	40-49	*Effort / quantify of work*: Unsatisfactory level of effort that falls short of expectations in handbook. Frequent encouragement required to maintain some motivation and presence within the research group. *Professional Conduct:* Modest level of management and organizational skill, reliability, and punctuality. Modest ability to take initiative and propose constructive ideas. The candidate is not always polite and/or did not always display an exemplary behaviour with supervisor's research group and within the lab.
E	30-39	Largely absent and disengaged from the project. Displays little motivation and needs constant supervisor encouragement to attend meetings. Bad level of management and organizational skill, reliability, and punctuality. Low ability to take initiative and propose constructive ideas. The candidate is not always polite and/or did not always display an exemplary behaviour with supervisor's research group and within the lab.

Assessment criteria for planning report and interim presentation

The planning report is assessed by your supervisor(s), and the oral presentation from your supervisor and the audience present (likely the supervisor's research group).

Grade	Mark Range	
A*	85-100	Outstanding breadth of knowledge about the project background to form aims and hypotheses. Outstandingly thorough project planning. Independent and innovative project specification. Complete risk register with all main risks identified and an extensive mitigation plan given. Outstanding evaluation plan with evidence of independent thinking. Rigorous ethical, sustainability and data security analysis, considering effects in all domains, on all stakeholders. Extensive preliminary results with critical discussion
A	70-84	Excellent planning and presentation. Substantial level of independent project specification, of analytic thought or creative ability. Most main risks identified, and an excellent mitigation plan given. Excellent evaluation plan. Excellent ethical sustainability and data security analysis that takes into consideration most aspects and most stakeholders. Substantial number of preliminary results with critical discussion.
B	60-69	Good planning and presentation. Some evidence of independent project specification. Some risks identified and the mitigation plan is sensible. Good evaluation plan. Good ethical, sustainability and data security analysis that considers some domains and stakeholders. Some preliminary results.
C	50-59	Project substantially correct and adequately presented. Adequate project planning and specification. Some risks identified, minimal or unrealistic mitigation plan. Adequate evaluation plan. Adequate ethical, sustainability and data security analysis: only a couple of stakeholders or domains considered. Minimal number of preliminary results.
D	40-49	Incomplete understanding of the project specification. Some competence in project planning. Very few or no risks identified. Basic evaluation plan. Minimal ethical, sustainability and data security analysis. Almost non-existent preliminary results.
E	30-39	Little or no evidence of project planning. Major defects in understanding of the projectspecification. Minimal or no risk register. Minimal or missing evaluation plan. Irrelevant ethical, sustainability and data security analysis No preliminary results.

Assessment criteria for the ethics, sustainability, data security in the planning report

Grade	Mark Range	Characteristics	
A*	85 - 100	As for a standard "A" grade, **but also demonstrates a creative and wide-reaching investigation of ethical, sustainability, and data security implications** of the work.	
A	70 - 84	Takes a comprehensive and global view of the implications and outcomes of the research and the interests of and effects on all stakeholders; including the environment, humankind, society and the public, the college, your fellow students and college members, those directly involved in the pursuit or products of the research, issues of sustainability, finance, social responsibility, ownership of findings or outcomes. Includes a clear, appropriate and implementable plan for data handling and storage. Wide ranging and assiduous search of relevant literature; clear and full references and citations	
B	60 - 69	Considers the implications and outcomes of the project for a range of stakeholders, with some discussion of sustainability, ethics, and data security issues. Shows recognition that engineers and scientists have **responsibilities beyond technical success**, including toward society, the environment, and secure handling of data. Includes a clear, implementable plan for data handling and storage. Undertakes a reasonable search of relevant literature, with acceptable referencing and citation. Demonstrates good awareness of the importance of ethical, sustainability, and data security considerations, though analysis may lack global or long-term perspective.	
C	50 - 59	Shows some recognition of the project's potential implications for stakeholders, with limited mention of sustainability, ethics, or data security. Some acknowledgement of professional responsibilities, but discussion is underdeveloped or narrow in scope. Includes a plan for data handling and storage Literature search is limited, with some references provided. Displays some awareness of ethical principles but incomplete understanding of sustainability or data security responsibilities.	
D	40 - 49	Incomplete or superficial consideration of ethical principles, sustainability, or data security; discussion limited mainly to the student's own perspective. Little or no consideration of impacts on society, the environment, or the broader scientific/engineering community. Limited discussion of how data will be stored. Incomplete coverage of literature, poor linking of information.	
E	30 - 39	The student does not engage with ethical, sustainability issues or discussions at all, but excuses this lack by "this project has no animal testing or live subject interactions, and therefore ethical permission is not required." No discussion of how data will be stored. Little or no evidence of literature searching, typically based on a single / few web based sources. No or few references	

Assessment criteria for the written element of the final report

The written element of the final report counts for 80% toward the final report mark and is arrived at based on the criteria below. The final report is marked by at least 2 approved markers.

Grade	Mark Range	Description
A* (1st upper)	90-100	The work is exemplary and is potentially publishable with minimal further editing. Complex observations and evaluations of literature that are of a professional standard have been made. The source material, field or laboratory work have been measured and recorded accurately, systematically and in meticulous detail. Data collection and presentation conform to industry/scientific journal standards. The use of technical terminology is accurate. The quality of data analysed and literature reviewed is more than adequate to support the interpretations made and demonstrates considerable effort and outstanding use of time management throughout the project. Complex interpretations have been made and have been communicated at the highest possible level. Interpretations are accurate, well-justified and show thorough knowledge of all the relevant literature. Discussions and Conclusions are highly innovative, in-depth, confirm or challenge existing models and show an outstanding ability to synthesise and criticise data from a wide range of sources. A thorough understanding of the work in its wider context has been demonstrated. Excellent problem-solving skills and the ability to make well- reasoned independent interpretations have been demonstrated. The work is concise, logically structured, grammatically correct and conforms wholly to the assessment guidelines. Citations are relevant and broad in scope, and accompanying references are correct and conform to the style of an academic journal. Figures are relevant, incorporate relevant and originally presented content, are of publishable quality and significantly enhance the understanding of the work.

A+ (1st mid)	80-89	The work is excellent and of a publishable standard with some additional editing. Very careful observations and evaluations of the literature have been made. The source material, field or laboratory work have been measured and recorded accurately, systematically and with very good attention to detail. Data collection and presentation conform to industry/scientific journal standards. The use of technical terminology is accurate. The quality of data analysed, and literature reviewed is more than adequate to support the interpretations made and demonstrate significant effort and very good time management throughout the project. Complex interpretations have been made and have been communicated to a very high standard. Interpretations are accurate, justified and show good knowledge of the relevant literature. Discussions and conclusions show some innovation, are in-depth, confirm or challenge existing models and show an excellent ability to synthesise and criticise data from a wide range of sources. A good understanding of the work in its wider context has been demonstrated. Very highly developed problem-solving skills and the ability to make independent interpretations have been demonstrated. The work is concise, logically structured, grammatically correct and conforms wholly to the assessment guidelines. Citations are relevant and accompanying references are correct and conform to the style of an academic journal. Figures are relevant, mostly incorporate relevant and originally presented content, are of excellent quality and enhance the understanding of the work.

A (1st lower)	70-79	The work is very good and of a publishable standard with significant additional editing. Careful observations and evaluations of the literature have been made. The source material, field or laboratory work have been measured and recorded accurately, systematically and with good attention to detail. Data collection and presentation conform to industry/scientific journal standards. The use of technical terminology is accurate. The quality of data analysed and literature reviewed is more than adequate to support the interpretations made and demonstrate good effort and good time management throughout the project. Complex interpretations have been made and have been communicated to a high standard. Interpretations are accurate, justified and show sound knowledge of the relevant literature. Discussions and conclusions are well-considered, in-depth, confirm or challenge existing models and demonstrate an ability to synthesise and criticise data from a wide range of sources. A sound understanding of the work in its wider context has been demonstrated. Highly-developed problem-solving skills and the ability to make some independent interpretations have been demonstrated. The work is concise, logically structured, grammatically correct and conforms to the assessment guidelines. Citations are relevant and accompanying references are correct and conform to the style of an academic journal. Figures are relevant, partly incorporate relevant and originally presented content, are of very good quality and make a valuable contribution to the understanding of the work.

B (upper 2nd)	60-69	The work is good. Good observations and evaluations of the literature have been made, but few are complex. The source material, field or laboratory work have been measured and recorded accurately, but more attention to detail is required. Data collection and presentation approach industry/scientific journal standards but fall short in one or more areas. The use of technical terminology is mostly accurate but falls short in one or more areas. The quality of data and literature reviewed is adequate to support the interpretations made and demonstrate reasonable effort and good time management throughout the project. Some complex interpretations have been made and have been communicated well. Interpretations are accurate, justified and show good knowledge of the relevant literature. Discussions and Conclusions show some consideration, confirm or question existing models in some aspects and demonstrate an ability to synthesise and criticise data from different sources. A reasonable understanding of the work in its wider context has been demonstrated. Good problem-solving skills and the ability to make some independent interpretations have been demonstrated. The work is relatively concise, has a good structure, is largely grammatically correct and conforms mostly to the assessment guidelines. Some citations are not relevant and/or key citations are absent. Accompanying references are largely correct and approach the style of an academic journal. Figures are relevant, partly incorporate relevant and originally presented content, are of good quality and add to the understanding of the work.

C (lower 2nd)	50-59	The work is mostly sound. Observations and evaluations of the literature are largely satisfactory but lack detail in one or more aspects. The source material, field or laboratory work have been measured and recorded accurately, but more care and/or attention to detail are required. Data collection and presentation fall short of industry/scientific journal standards in one or more areas. The use of technical terminology is sometimes incorrect. More and/or better quality data and literature could have been reviewed to help support the interpretations made and better use of time could have been made throughout the project. Few complex interpretations have been made. Interpretations show some weaknesses and/or are not fully supported by the data presented and/or by the relevant literature. Discussions and Conclusions show evidence of some independent thought, but do not confirm or challenge existing models. Limited understanding of the work in its wider context has been demonstrated. Problem-solving skills have been demonstrated, but independent interpretation is limited in scope. The work contains some irrelevant or inconsistent material, has some issues with structure, shows grammatical inaccuracies and/or does not conform to the assessment guidelines in one or more areas. Some citations are not relevant and more citations are required to support interpretations. Accompanying references show inaccuracies and fall short of the standard for an academicjournal. Some figures used are not relevant, incorporate limited relevant or originally presented content, and/or are of poor quality.

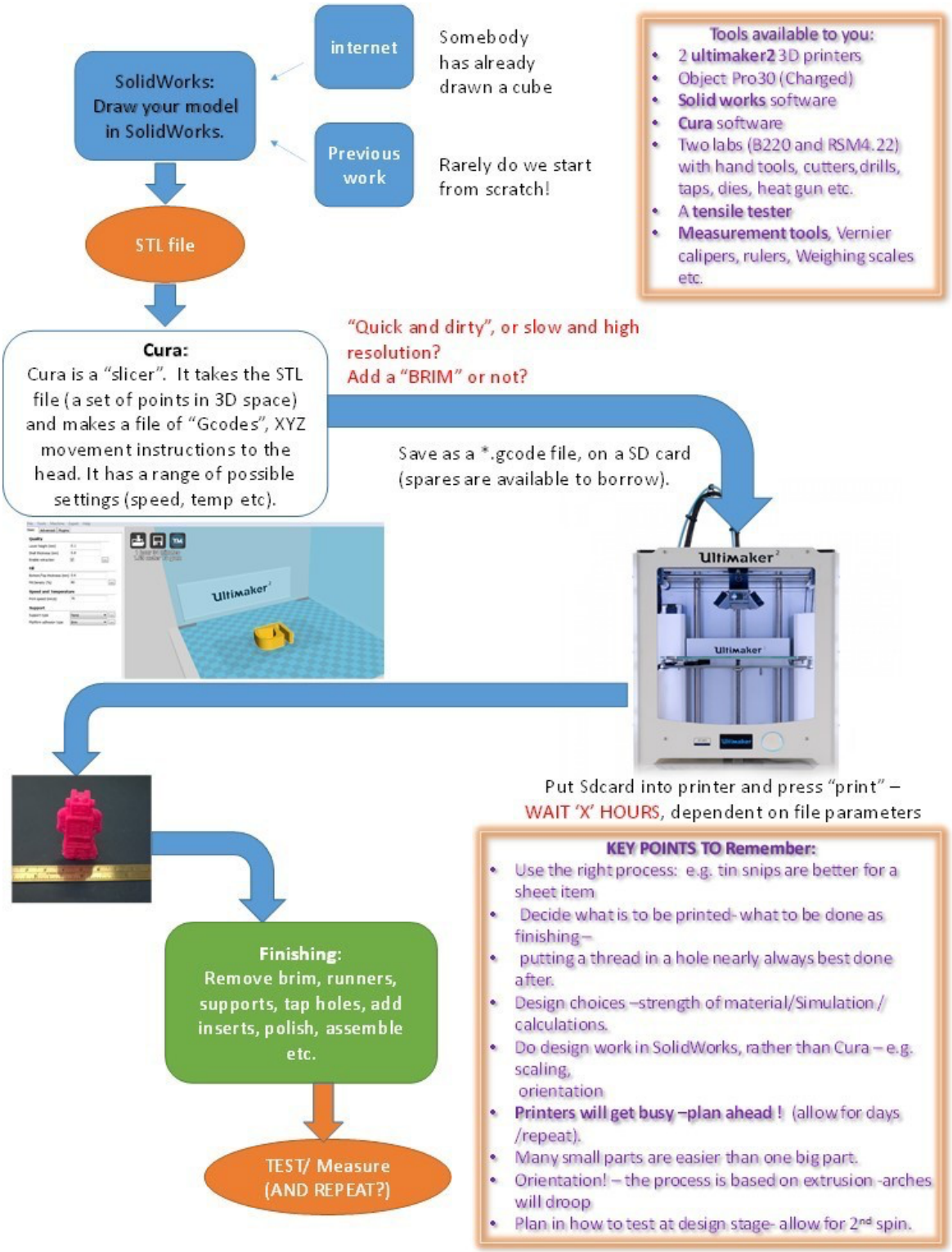
D (3rd)	40-49	The work is sound in parts but falls below a satisfactory standard in several areas. Only general observations and evaluations of the literature have been made. The source material, field or laboratory work have been measured and recorded but commonly with insufficient accuracy and/or detail. Data collection and presentation consistently fall short of industry/scientific journal standards. The use of technical terminology is often incorrect. Interpretations are very weak and are limited by the amount and/or quality of data collected or literature reviewed. Much better use of time could have been made throughout the project. Only very general interpretations have been made. Interpretations are very weak and/or not supported by the data presented and/or show very limited knowledge of the relevant literature. Discussions and Conclusions are commonly inconsistent and do not confirm or challenge existing models. A poor understanding of the work in its wider context has been demonstrated. Few problem-solving skills have been demonstrated and independent interpretation is very limited in scope. The work contains irrelevant and/or inconsistent material and has a confused structure. Grammatical inaccuracies are common and the work does not conform to the assessment guidelines. Inadequate/irrelevant citations have been made. Accompanying references show inaccuracies and fall short of the standard for an academic journal. Many of the figures and much of the content are not relevant, incorporate negligible originally presented content, and/or are of poor quality.

Assessment criteria for presentation day

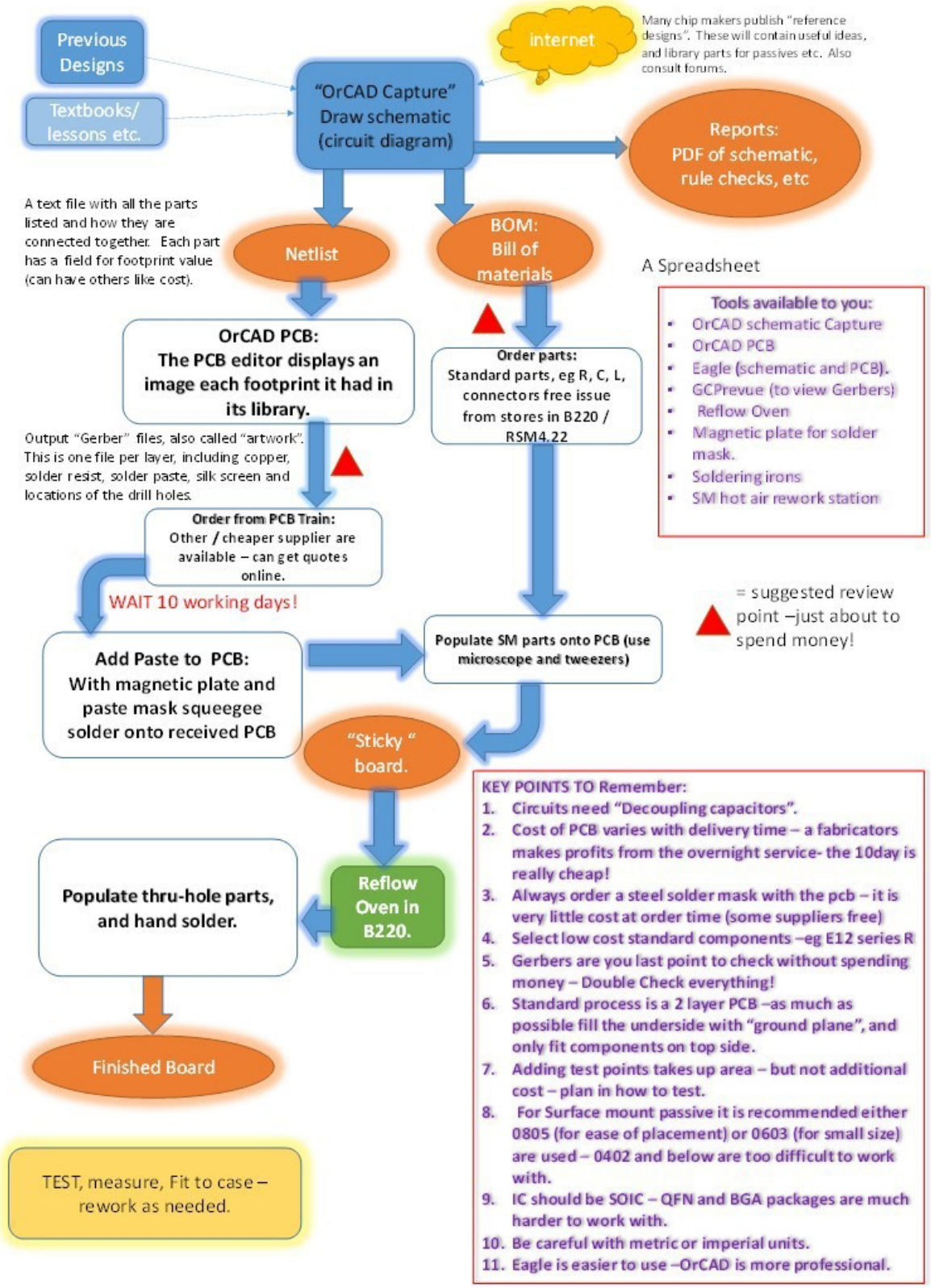
Grade	Mark Range	Assessment criteria
A*	85-100	Outstanding presentation - Outstanding content quality of the results presented along with an outstanding introduction to the overall project and extremely clear dissemination of the project goals. Complex interpretations have been made and have been communicated at the highest possible level. - Outstanding presence on stage with strong motivation and energy. The candidate is engaging the audience extremely well. - Outstanding flow efficiency in delivery of information. Extreme clarity in every part of the presentation. The presentation was in time and flawlessly delivered. Discussions and Conclusions show an outstanding ability to synthesise and criticise data from a wide range of sources. - Outstanding visual layout with substantial amount of creativity. The figures presented are extremely clear, relevant, and incorporate relevant and originally presented content. - Outstanding organisation of the presentation with substantial amount of creativity. The presentation is logically structured and conforms wholly to the assessment guidelines. - Outstanding response to questions demonstrating deep knowledge of the project and substantial amount of independent thinking. A thorough understanding of the work in its wider context has been demonstrated.
A	70-84	Excellent presentation fully satisfying expectations in handbook. - Excellent quality of the results, with an excellent introduction to the overall project and project goals. Complex interpretations have been made and have been communicated at a high level. Interpretations are accurate, well-justified and show thorough knowledge of all the relevant literature. - Excellent delivery of the presentation that engaged the audience. - Excellent flow efficiency in delivery of information. Clarity in every part of the presentation. The presentation was in time and flawlessly delivered. Discussions and Conclusions have shown an excellent ability to synthesise and criticise data from a wide range of sources. - Excellent visual layout with demonstrating creativity. The figures presented are clear, relevant and incorporate relevant and originally presented content. - Excellent organisation of the presentation that is logically structured. - Excellent response to questions demonstrating deep knowledge in the project and substantial amount of independent thinking. A thorough understanding of the work in its wider context has been demonstrated.

B	60-69	- Strong level of effort put into the presentation. - The visual layout is sufficient to follow the presentation. - The presentation is fairly well organized with logical structure. - The figures presented are fairly clear and incorporate relevant content. The discussion is adequate, and the conclusions drawn sensible. Understanding of the work in its wider context was demonstrated adequately. - The presentation was delivered on time but was not very engaging. - Answered questions well, but sometimes required some prodding / help.
C	50-59	- Modest level of effort put into the presentation. Not engaging with the audience. - Decent organization of the presentation with logical structure at large. - The figures presented were note always clear or incorporate relevant content. - The discussion was limited, and the conclusions drawn were not always appropriate. - Understanding of the work in its wider context was not quite demonstrated. - The presentation may have not been delivered on time. - Was unable to answer some questions or answered with prodding / help.
D	40-49	- Unsatisfactory level of effort put into delivering the presentation. - Fairly disorganized content, unclear objectives, cluttered slides. - Very limited discussion of the work. - Could not demonstrate understanding of the work in its wider context. - The presentation may have not been delivered on time. - Difficulties in understanding the relevance of questions asked and could not answer most of the questions.
E	30-39	- Presentation completely unclear. - Unsatisfactory level of effort put into delivering the presentation. - Completely disorganized content, unclear objectives, cluttered slides. - Largely absent and disengaged from the presentation. - Displayed little motivation and interest in the presentation. - The presentation may have not been delivered on time. - Could not understand and answer questions.

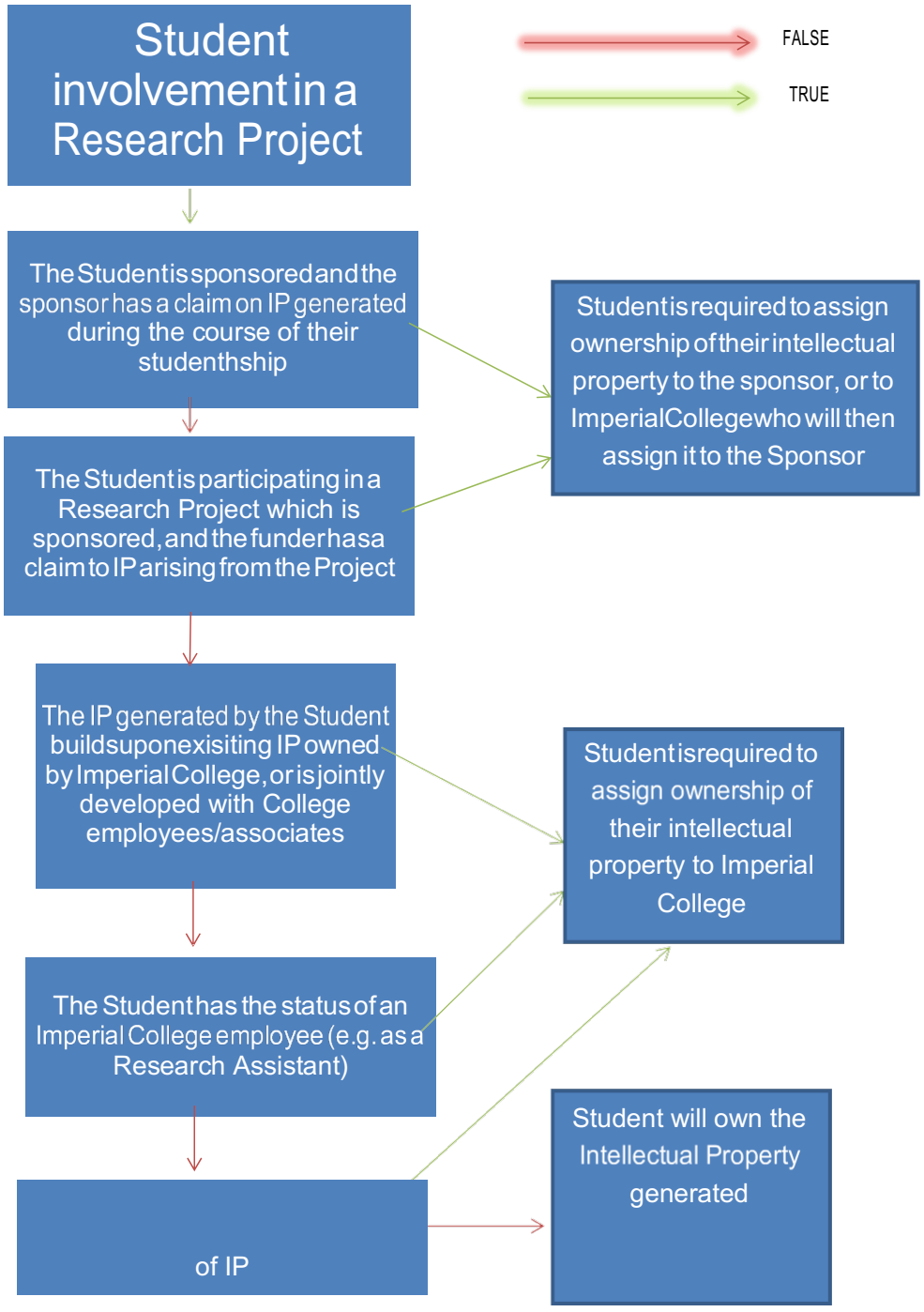
APPENDIX 3 – DESIGN FLOW FOR 3D PRINTING



APPENDIX 4 – DESIGN FLOW FOR A PRINTED CIRCUIT BOARD (PCB)



APPENDIX 5 – INTELLECTUAL PROPERTY* (IP)



*Please refer to the official guidelines of Imperial College London for more informations.

APPENDIX 6 – Ethics

Engineering Ethics for Bioengineering

The public and the Engineering Council expect solid ethical behaviour and thinking from engineers. The Engineering Council have a Statement on Engineering Ethics, which highlights four pillars on which the ten principles of Ethical Engineering Behaviour stand.

These Pillars are:

- Honesty and integrity
- Respect for life, law, the environment and public good
- Accuracy and rigour
- Leadership and communication

Ethics is not just about animal or patient testing. Ethics is about making the right choices in what we do and say, and understanding why those choices are right or not. The lecturer at the heart of the Cambridge Analytica scandal said "I wasn't doing anything wrong": it is true he was not breaking any laws, but quite clearly he was acting unethically. So what was wrong with his thinking?

Ethics is about what is true, right or fair; on what basis it can be said to be true, right or fair, and by whom. In particular, engineering ethics requires us to think about ALL stakeholders in any endeavour. The Engineering Council have clear and strong guidelines on this, and you have been informed about these and given the links.

Personal ethics (or personal moral bases) are often about what we don't do and why, but Professional Ethics (such as Engineering Ethics) often go further and have a positive aspect: about things we should do or must do as well as what we don't do. So, for example, Engineering Ethics includes a Whistleblower Clause: that an engineer is duty bound to call out bad or wrong behaviour or work. This also has been adopted into the Imperial College expectations regarding bullying or discrimination (of any sort): that if one observes this one should call it out.

As Imperial Undergraduate students you would have undertaken Ethics training in First Year, prepared an ethical analysis of a case study, and had refresher material in your second year. You would further have undertaken an ethical analysis of your Design & Professional Practice 2 project.

In the ethics training, we consider three lead questions:

1. Is it true?
2. Is it fair?
3. Is it wise?
4.

These then break down into six domains of ethical consideration:

Is it true:

A. Scientific Integrity: how sure can we be that our findings/results are true and reliable? We owe a duty of honesty and care to our scientific colleagues and the wider public to ensure that what we claim/state/declare is really true and founded on solid scientific work. This is relevant to all bioengineering projects. That our methods and assumptions are trustworthy and reliable, that our conclusions and data analysis are truthful and solid, and that our publications are truthful and well supported, and that our statistical methods are appropriate and reliable.

Is it fair:

B. Scientific collegiality: we owe it to our colleagues in the department and our wider field to deliver trustworthy work and not discredit Bioengineers or scientists. That means the sharper collegiality of building our Department as a leading and trustworthy centre of excellence, but also colleagues in other departments and colleges rely on us to build the public standing of bioengineers. Students owe it to other students to study and perform honestly and fairly, not seeking unfair advantage (no cheating or academic misconduct)
C. Protection of Human Subjects: relations between researchers and human subjects. This includes protection from harm; respect; autonomy' beneficence' and justice. It includes informed consent and assent, confidentiality and anonymity (GDPR), and not exposing subjects to research risks.
D. Animal Welfare: relationships between researchers and animal subjects. This is strongly controlled by the Home Office and the Animals (Scientific Procedures) Act 1986.

Is it wise?:

E. Institutional Integrity: relationships between researchers and their sponsors, funding agencies and government. This includes being careful about with whom we collaborate or from whom we accept support or funding, recognising or avoiding conflicts of interest or conflicts of commitment; regulatory compliance.

F. Social Responsibility: relationship between research and the common good. This also reaches wider than our normal thoughts of ethics to include fiscal responsibility, public service, public education, environmental impact, gaining/maintaining public support. So issues like Artificial Intelligence or Genetic Engineering and the potential longterm effects, societal impacts (always important in Healthcare Science)

In your section of your project report, you should consider all six of these domains and the effects on ALL stakeholders (including the environment, society and the biota) in the realms of wellbeing (health and welfare), autonomy (freedom and choice) and justice (fairness). Note that only C and D are about protecting the subjects of research or investigations – there are always wider ethical issues to be considered in Bioengineering projects. You should especially not neglect Domains A, B, E and F, but should also link your considerations into the ten clauses of the Engineering Council "Codes of Conduct for Engineers".

Principles at work

Of course, there has been much more discussion and debate about Medical Ethics, and it is generally considered that Medical Ethics is "the application of traditional moral theory to questions of ethics that arise in medicine"[1]. On that basis, Engineering Ethics is also the application of moral theory to engineering. Furthermore, it can be seen that, to examine ethical issues and processes one needs to examine and explore one's own Moral theories and beliefs.

However, it can be further argued that professional ethics are actually also distinct from Personal Ethics (as the Engineering Council recognise), and impose a moral framework and stance distinct from our own personal moral framework. This can be a challenge or a source of personal struggle.

It is generally recognised that there are four prime principles underpinning an approach to Medical Ethics: autonomy, beneficence, non-maleficence, and justice.

This is to say that, in an ethical approach, one should respect:

1. Autonomy: the freedom and free choice of every individual likely to be affected by the policy or action.
2. Beneficence: only actions which bring about good to the individuals considered should be undertaken, and doctors should always act in the best interests of patients whilst it is in their power to do so.
3. Non- maleficence (is in some ways a corollary to 2): no actions should be undertaken which may cause harm to the individual concerned (this is the famous principle enshrined in the Hippocratic Oath, for example), and likewise the doctor should not refrain from acting if this is going to cause harm to the individuals concerned.
4. Justice: all actions should be seen to be just and fair to all individuals concerned.

Some of the underlying principles that might inform and shape our responses include:

1. Utilitarianism – doing the greatest good for the greatest number of people.
2. Universalism: Right or wrong are always right or wrong, whatever the circumstances.
3. Deontology: that is the way the world (life, the universe, whatever) is, and so it logically follows from that. (Note that this is the core issue in Animal rights and Veganism – a personal belief that "All creatures are equal", or the converse).
4. Reversibility: what if the roles were reversed?
5. Equality – giving equal respect to all persons#.
6. Consequentialism – that the end may justify the means.
7. Personal integrity – that a noble person demonstrates their nobility by upholding/following noble principles always.

It should be clear that whatever project a student is undertaking there will always be ethical questions that can and should be asked about it, and the student should explore these thoroughly in the Ethical Analysis.

The key features to look for in the students' work is to explore all possible stakeholders under all six of the domains described above: anything less is an avoidance of their duty to think and act ethically as engineers.

Note that Engineering Ethics, with duties to Society, the public, the biosphere and all others may also be in conflict with some of these principles, and thus may need discussion and reconsideration. For some engineers this may be difficult to resolve and should be discussed with care.

References:

1. Rhodes R. The Trusted Doctor: Medical Ethics and Professionalism. Oxford, UK: Oxford University Press; 20