Part IA guide

The Engineering Tripos comprises a two-year Part I followed by a two-year Part II - together they comprise the MEng. All CUED undergraduates study the same subjects for their first five terms. There is an element of choice in the sixth term, and in Part II students specialise in a chosen engineering area.

NB. Throughout this guide 'week' refers to Thursday to Wednesday of the normal teaching term.

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Aims & objectives

Teaching aims

The aims of Part I of the Engineering Tripos are to encourage and enable students to:

- develop a sound understanding of the fundamentals of engineering science across a broad range of engineering disciplines;
- acquire basic skills in modelling and analysis and the ability to solve straightforward technical problems;
- acquire basic design skills and the ability to create simple engineering designs using a multi-disciplinary approach;
- develop an awareness of the responsibilities of engineers in economic, social and environmental matters;
- develop practical skills and the ability to conduct and evaluate experiments;
- learn to create, use and evaluate computer software;
- develop communication skills, both oral and written;
- develop cooperative skills through group and teamwork activities;
- acquire basic study skills and develop independence of learning;
- develop a responsible and professional attitude.

General objectives

At the end of the Part I course students should:

- by means of lecture courses, associated examples papers and appropriate reading have learnt the fundamental principles of engineering science;
- by means of laboratory courses have witnessed phenomena associated with the material in the lecture courses, have gained an understanding of experimental methods and have experience of experimental

techniques;
- by means of practical computing courses be able to create and evaluate software;
- by means of projects have been introduced to research and design;
- by means of a course in exposition and subsequent practice have developed powers of presentation both orally and in writing;
- by means of lecture courses, occasional lectures, essay assignments and industrial experience have gained an introduction to manufacturing, management and the economic, environmental and social responsibilities of engineers.

The progress of each undergraduate is measured by Tripos examinations and by assessed coursework. Tripos classes and details of marks are notified to undergraduates through CamSIS or by their Colleges, and progress with coursework is communicated by staff marking individual coursework activities.

Achievement of the general objectives is dependent on an undergraduate reaching detailed objectives set for individual activities of the course. These are listed in the syllabuses for each series of lectures and the instruction sheets for coursework.

Part IA structure

Lectures

Lectures are timetabled throughout the Michaelmas and Lent terms, and the first four weeks of the Easter term.

All students take the same four 3-hour examinations at the end of their first year. These papers and the lecture courses examined in them are:

Paper 1	Mechanical engineering	Mechanics (16 lectures) Mechanical vibrations (12 lectures) Thermofluid mechanics (24 lectures)
Paper 2	Structures & materials	Structural mechanics (24 lectures) Materials (20 lectures)
Paper 3	Electrical & information engineering	Physical principles of electronics, electromagnetics (12 lectures) Linear circuits and devices, AC power (22 lectures) Digital circuits and information processing (16 lectures)
Paper 4	Mathematical methods	Mathematics (39 lectures) Computing (2 lectures + coursework lectures)

Engineering applications (8 lectures)

These sessions illustrate the applications of engineering principles in the widest possible context over a broad range of technologies.

Examples papers

One examples paper is issued for about every four lectures, on Wednesdays according to the termly schedule. The material is followed up in College supervisions.

The schedule for the examples paper release can be found on the Examples paper Moodle page. Solutions (cribs) of each examples paper will be made available to students online approximately three weeks after the issue of the paper.

Coursework

Important engineering skills are developed in a wide variety of coursework exercises. The Michaelmas term includes induction activities which lay foundations for the rest of the course.

Part I labs & coursework: general info

Coursework credit

Coursework in Engineering includes lab work and projects, plus a number of other marked assignments.

In Parts IA and IB, all coursework is for standard credit, which means that once students achieve a satisfactory standard in the various groups of activities the associated marks are capped at the qualifying level. Students who fail to reach the qualifying marks, or who fail to attend or hand in certain coursework, will have the shortfall deducted from their total in the Tripos. The marks available and qualifying marks are shown in the Faculty Board Part IA and Part IB coursework and exam credit notices.

The standard credit scheme has been designed to encourage students to attend coursework sessions punctually, to complete each laboratory-based activity within an appropriate time to a satisfactory standard so as to achieve the main objectives of the activity, and to submit any written work for marking within a specified timescale.

The system aims to help students by discouraging them from spending an inordinately long time on any one coursework activity, at the expense of other aspects of their study. It also encourages innovation in design work, as there is not an undue loss of marks for a less successful outcome.

The majority of students are expected to gain the qualifying standard.

General guidelines

- **Charts** in the individual lab expand the lab/coursework schedule into particular activities. Check beforehand that you know the location of your next exercise.
- **Penalties** apply for students arriving late to labs.
- Be aware of the procedure for **rearranging** missed coursework sessions.
- Read the **lab safety instructions below** and observe any special instructions on safety in individual labs. You should bring safety glasses, issued at the start of the year, for all materials labs (in the Lent and Easter terms) and for the structural design course practical work. You may be excluded from labs if you do not bring them.
- Students are advised to read the handout for the experiment online before attending the lab session. Printed copies of the handout will be available at the start of each lab.
- For much of the Part I lab work in the Lent and Easter terms you will need to use your **lab book** for recording data and taking notes during laboratory experiments. You are encouraged to word-process lab reports, which should be glued or stapled into your lab book.
- Experiments are classified as either **short** or **long**:
    - A short experiment occupies a 2-hour period and is completed and signed-up in that time.
    - A long experiment occupies 2 hours in the lab and is then written up as a report.
- Any urgent **problems** with an experiment or exercise should be reported to a demonstrator or the lab leader in charge of the laboratory.
- The report for each long lab should be set out in the lab notebook provided at the start of the year. Your report, together with that of your partner, will be **marked** by a demonstrator at a signing session. This must take place within 15 days of the date of the experiment.
- **Signing** sessions should be booked during the blank periods on the lab schedule. Demonstrators will give guidance on the form and content of the report expected for a particular experiment. It is important that you bring your lab notebook with you to each long experiment.
- **Credit** for the satisfactory performance of a short experiment is 2 marks. Credit for a long experiment is on the scale 0-6, with 4 marks for completion of the experiment and minimally acceptable work, 5 marks for satisfactory work and 6 for exceptional work. Late submission of a report incurs a deduction of 1 mark for each week, or part of a week, after the due date.

Lab safety instructions

1. No eating, drinking or smoking is allowed in the labs or drawing or computing areas.
2. You should always comply with the safety instructions either issued by a demonstrator or displayed on notices alongside equipment.
3. You should bring your safety glasses to all labs and wear them when needed.
4. Do not put scarves, coats, etc., on the benches or stools; hang them up on the racks provided.
5. Do not put books, cases, etc., on top of electrical equipment; overheating with consequent damage may result.
6. Do not wear loose clothing or scarves near rotating machinery.
7. Do not take leads, components or equipment from other lab locations. All the apparatus you need should be present; if it is not ask a demonstrator.
8. At the conclusion of an experiment leave the apparatus as you found it. Report any faults in the equipment which you use. If all faults are speedily reported you should seldom find faulty equipment.
9. Observe special instructions on safety which are posted in the individual labs.
10. Finally, if you run into difficulties, don't waste time - ask a demonstrator for help.

The lab record and long report

It is essential that you bring your lab notebook with you whenever you are timetabled to perform a long experiment. The notebook should be used to record all the readings, observations and calculations that you make, unless the instruction sheet specifically states otherwise. Do not use loose sheets of paper: these are easily misplaced. Charts and other records should be glued or stapled into your notebook.

Your lab record should start on a new page for each experiment performed. It should follow good professional practice and be correctly headed and dated. When there are several readings to enter, arrange these in tabular form, and make sure that the column headings show the quantity measured and the units used. Decide on how many columns you need and set out the table before you start taking readings. Whenever feasible, plot graphs as the experiment proceeds so that serious divergence from the expected behaviour can be checked there and then. Label the axes of the graphs and, where appropriate, indicate the accuracy of the data points on the graph.

The “report writing guide” covers all aspects of report writing in the Engineering Tripos. Specific sections are introduced via IA Exposition classes. For experiments and reports in Part I, you are referred in particular to the following sections:

- Report writing in the Engineering Tripos: long lab records and reports
- Introduction to technical writing: integrity, record-keeping, plagiarism and referencing

Difficulties with the lab report

If you need advice on a particular aspect of your report or you are otherwise held up on some point, then seek help. You can obtain help from a demonstrator in the laboratory or your supervisor. Do this in good time and you will not be rushed into producing an unsatisfactory report.

Copying the work of others is unacceptable. However, discussing your work with colleagues, supervisors or demonstrators is encouraged and can bring about improvements to the standard of the report you submit. The report itself must be your work, written in your own words. Students who submit the work of others as their own will have their reports referred to the appropriate authorities.

Contact details of lab leaders and technicians are available online: IA, IB.

Feedback on labs & experiments

If you have comments about any experiment, please tell us about them using the fast feedback facility. Urgent problems with an experiment should be reported immediately to a demonstrator or senior technician in the lab, or contact the member of staff in charge of the lab. Please be constructive in your comments and suggestions.

You should be given 5 minutes during lab time to complete a short survey on each activity. Please do so as this gives us the information that we need to improve the activities in the future.

Part IA coursework & labs overview

Introduction

Outlines of the Part IA coursework activities and experiments are given below, together with the number of timetabled sessions allocated to them.

Also see the general information about Part I labs & coursework above.

Drawing

The Drawing course runs in the Michaelmas and Lent terms only.

In Michaelmas, the focus is on Computer Aided Design (CAD), emphasising the basic functionality of commercial CAD software. The course starts with an introductory lecture in LT0 and is then delivered through a series of self-paced tutorials and tasks that are supported by helpdesk sessions. Students are required to work through the tutorials and tasks prior to their scheduled marking sessions, using the helpdesk as required before then.

In Lent, the focus is on manual drawing, emphasising the principles and practices that define how three-dimensional objects are represented on two dimensional surfaces (such as paper). Each timetabled drawing session, both morning and afternoon, begins with a lecture to outline the material that will be covered in the following practical class. Students are expected to attend both the lecture and the following practical class. Work set for each drawing class must be handed in at the end of each session. Students should avoid commitment to other afternoon activities on the one day a fortnight when they are scheduled to attend drawing classes (see the lab & coursework schedules). Supervisions should be timetabled to avoid afternoon lab sessions.

Most of the equipment required for the practical drawing sessions is provided. See additional course costs for details of the drawing equipment that students are expected to have.

Exposition

The communication of technical information is developed through the exposition course which aims to improve students' presentation, discussion and writing skills. Students' lab reports on an **electronic filters experiment** are critically reviewed during these sessions. In addition, each student is required to give a short (10-15 minute) talk on technical material and to take part in a debate on a current technical topic, or other appropriate activity. The topics chosen are at the discretion of the group leader. The good practice initiated during the exposition exercises is developed throughout the course, whenever students write laboratory or project reports, essays or give oral presentations on their project work.

Engineer in society, principles of design, product design project and dimensional analysis

Eight lectures are given on the role of the engineer in society, in which the wider issues that influence technical decision making are discussed. Students' assimilation of the lecture material and their reading around the subject is assessed through a report. There are also eight lectures on the principles of design, assessed through the product design project. The principles of dimensional analysis are covered in four lectures at the start of term followed by two experiments (and questions may be set on this topic in the Part IA examinations).

NB. Attendance at **all** these lectures is necessary for students to complete their coursework satisfactorily.

Computing and microprocessors

The Michaelmas Term part of the course involves 12 activities for self-study, and each activity has exercises to be completed. All the material and documentation for the course will be made available online, through the course

Moodle page which will also list ways to get help.

The Lent Term activity is a group exercise, with students working in pairs. Each student takes charge of writing part of a software solution. A modular design and unit testing are required to ensure that the two parts work together correctly.

Microprocessors and learning how to program them are introduced through a series of labs in the Easter term.

The computing course is examined in Paper 4 Mathematical Methods. An open-ended long vacation exercise (the "**Mars lander**") aims to keep computing skills fresh for Part IB.

Structural design project

Creative thinking and synthesis are fostered in design projects. All students undertake a Structural Design Project. Working in pairs, they design, manufacture and test a metal structure to carry given loads at minimum cost. The structures are tested to destruction in ascending order of 'cost'. After the test, recommendations are made on how the design might be improved. Assessment is by the quality of the tested product, the quality of the drawings and the individual reports.

Integrated electrical project

This experiment is not lab-based, and instead is something you can work on in your own space. Using the electronics kit you will be given towards the start of term, you will have a series of exercises to complete whereby you will build a number of circuits, and upload your findings to Moodle. These activities will run in parallel with the Physical Principles of Electronics and Analysis of Circuits lectures, and will also form part of exposition. Full details will be provided by Prof Wilkinson during the above lectures.

Design challenge

The "IA Design Challenge" introduces a structured design process and highlights the role of design in developing innovative products, systems and services. The course provides an opportunity for students to work together in teams to address a real-world design challenge, focussing on social, environmental and economic factors.

The course is delivered in collaboration with Engineers Without Borders (EWB, UK), as part of their annual national Engineering for people design challenge. EWB provide a briefing pack that characterises a specific context within which design problems and opportunities can be identified.

Outline of coursework activities

Term	Coursework	No. of timetabled 2-hour (morning) lab sessions + afternoons
Michaelmas	Lego Mindstorms Dimensional analysis Statics experiment Exposition Computing	5 (2 or 3 in afternoons) 2 1 8 Help desk and marking sessions run at the times shown in the lab calendar.
Christmas Vacation	Report on 'the engineer in society'	
Michaelmas, Lent and Easter	Drawing (CAD and Engineering Drawing) Structural design project	9 + 9 afternoons 5 + 5 afternoons

Term	Coursework	No. of timetabled 2-hour (morning) lab sessions + afternoons
	Integrated electrical project Machine Tool lab	1
Lent and Easter	Microprocessors Computing Experiments	2 + 1 afternoon 2 + 2 afternoons 12
Lent Term, Easter Vacation	Design challenge	

Outline of experiments (Lent/Easter terms)

Students undertake 11 experiments during the Lent term and the first three weeks of the Easter term. The topics on which these experiments are based are listed below. Some experiments are 'short'. These straightforward experiments aim to give students experience of important techniques and phenomena. Each task is completed and signed up in the two-hour morning period assigned to it. 'Long' experiments normally require two hours in the laboratory to complete the investigation and record the results, with an extra two hours on writing-up and drawing conclusions, and a subsequent sign-up session.

Associated paper	Experiment number and title	Long or short
Mechanics:	1. Measurement of vehicle motion 2. Vibration modes 8. Angular momentum	L S S
Thermofluids:	2. Stirling engine 9. Turbocharger 10. Inviscid fluid flow	L S S
Structures:	3. Elastic beams	L
Materials:	4. Plasticity and fracture	L
Electrical and information:	12. Iron-cored transformer 13. AC Power 14. Combinational logic 15. Sequential logic, memory and counting	S S S S

Lecture & lab start times

Lectures

Lectures run from five minutes past the hour to five minutes to the hour, with the following exception:

Part IA and IB lectures in the Constance Tipper Lecture Theatre will start promptly at 9am and 10am. Lecturers will start lecturing at precisely 9am in order to fit in the full 50 minutes of teaching that they need to deliver:

- First lecture 09.00-09.50 (non-standard)
- Second lecture 10.00-10.50 (non-standard)
- Third lecture 11.05-11.55
- Fourth lecture 12.05-12.55

This schedule allows the Constance Tipper Lecture Theatre to empty and refill at 11am. Students should leave the lecture theatre by the doors at the front and on the North side at the back (leading to the roadway), allowing students to enter from the foyer and the courtyard.

Labs

Morning laboratory/coursework sessions begin at 5 minutes past the hour.

Afternoon activities start on the hour.

Part IA & IB lateness penalties

Morning laboratory/coursework sessions begin at 5 minutes past the hour.

Afternoon activities start on the hour.

1. Students arriving up to 10 minutes late will be penalised 1 mark for late arrival, but may be excluded entirely at the discretion of the demonstrator in charge.
2. Students arriving more than 10 minutes late, will be automatically excluded from any laboratory experiment. For other coursework activities (e.g. computing, drawing etc.) the student may, at the discretion of the demonstrator, be allowed to take part in the activity, but will be penalised for late arrival.
3. Students who arrive late due to circumstances beyond their control should first try to rearrange the coursework activity. If this is not possible they may make an application for recovery of marks using the standard allowance procedure.

Rearranging coursework & deadline extensions

Although we expect students to attend all lab sessions and respect coursework deadlines, there may be a number of reasons why this might be problematic. In such cases you might be able to rearrange your coursework or apply for a deadline extension as appropriate. See the following pages for further information:

- Department Missed Coursework Activities and Deadline Extension Policy

Good academic practice vs academic misconduct (including plagiarism)

The University provides guidance on Plagiarism and Academic Misconduct which can be found at https://www.plagiarism.admin.cam.ac.uk, where academic misconduct includes any practice that may unfairly advantage a student's academic assessment (which includes plagiarism).

Suspected cases of Plagiarism and Academic Misconduct will be handled by the Director of Undergraduate Education in conjunction with the relevant Chair of Examiners, which may result in the case being referred to the University's Office of Student Conduct, Complaints and Appeals for consideration under the disciplinary regulations.

You should read and ensure that you understand the Department's guidance on avoiding academic misconduct, which covers:

- definition of academic misconduct

- plagiarism avoidance: expectations of all students
- distinguishing between cooperation and cheating
- sources of guidance on academic integrity, record keeping & referencing

If you have any queries please speak to your DoS.

Exam information

See the practical exam information page for details of:

- the exam period, location & timetable
- preparing for exams
- documents & equipment allowed during exams
- the day of the exams
- after the exams

You may also be interested in:

- the Guidelines for Examiners and Assessors: Part IA, Part IB
- the Department's statement on assessment types for an explanation of the differences between formative and summative assessment activities and details of how you can expect to receive feedback on your performance throughout the course.

Progression through the Tripos

A summary of the results that students must obtain to continue with the next part of the course is available at this link. Formal and detailed information about progression requirements is contained in Statutes and Ordinances.

Accreditation

At present the four-year MEng pathways with the exception of the 'Engineering Science' pathway offered by the Department of Engineering are accredited by one or more of the professional engineering institutions, depending on the engineering area studied.

Students are also strongly encouraged to become student or affiliate members of the professional institutions which particularly relate to their interests.

For further details of the accrediting bodies, membership benefits and contact officers within CUED see the Accreditation of the MEng.

How to give feedback on the course

Your feedback is **essential** for informing the development of the Tripos. Staff take it very seriously and every year it leads to real changes, for example:

- the introduction of the Dyson Centre
- the redesign of the Department's Library
- extending the Part IB exam period
- introducing more practical Part I lab sessions

- more staff training on supporting students with mental health difficulties.

We appreciate that it can feel like you are being bombarded with requests to complete surveys see **our page on student surveys and giving feedback on the course** for details of the feedback mechanisms which the Department particularly values. These include the fast feedback facility, course-specific and national surveys and the best lecturers awards.

Please ensure that all comments comply with the Department's code of conduct for survey respondents.

Inclusive teaching

The Department's approach

The Equality Act (2010) requires higher education institutions to take positive steps to make their education accessible to disabled students and to make 'reasonable adjustments' to provision to ensure that disabled students are not disadvantaged. Disabilities may include physical or mental impairments: the majority of these students have specific learning difficulty (SpLD) in the form of dyslexia. The University has a Code of Practice on Reasonable Adjustments for Disabled Students and the Accessibility and Resource Centre has some standard recommendations for appropriate academic support for such students. Further provision may be required in particular cases.

In an organisation of our size and complexity, individual variations in provision are potentially disruptive. However, many of the suggested adjustments are just good educational practice, so represent things we should be doing anyway as a Department that takes pride in the excellence of its teaching. Indeed, we already follow many of the recommendations (e.g. provision of cribs). The approach we have adopted is therefore to aim to have inclusive standard procedures for all teaching activities. Students are expected to make use of available resources to suit their needs, and to contact staff themselves (e.g. lecturers, lab leaders) if additional material is required.

The syllabus pages will give you lecturer details for part IA and part IB lecturers. Lab leader details can be found here for IA and IB.

Contact details of part II lecturers can be found on the relevant syllabus pages.

Any enquiries should be addressed to the Director of Undergraduate Education.

Facuty Board recommendations

- Electronic versions of handouts should be made available online 24 hours in advance of lectures or other teaching sessions (e.g. labs). [This allows students who do have special requirements to produce their own customised hard copy if they wish: e.g. single-sided; large format; non-white background].
- Filled-in versions of notes should be made available online after lectures, ideally within a week but certainly by the end of term.
- Recording lectures (audio) is often recommended to students as a learning aid. Students are permitted to use the recording only for their own personal study, and acknowledging IP and copyright. Lecturers are asked to consent to their lectures being recorded under these conditions.
- In labs, instruction should be provided in both written and verbal form.
- Lecturers should remember to pay attention to 'signposting' e.g. statement a start of each lecture of what is being covered; tracking progression throughout lecture; summary of main teaching points at end.
- All staff should make particular effort to put new vocabulary into context and explain new concepts. It is helpful to provide some repetition.

Sensus Access

Sensus Access is a free self-service facility which is designed to allow diabled students and staff (or those supporting them) to create accessible alternative formats of inaccessible digital documents. Further information is available on the Accessibility and Resource Centre's website.

Course material on Moodle

Most of the Department's courses have a page on the University's Virtual Learning Environment Moodle.

These pages are maintained by course lecturers. Students registered to these courses are automatically enrolled at the start of the course and can engage in the course activities, including coursework submission when appropriate.

The department makes a self enrollment key available for most courses so that students choosing courses in IIA and IIB can make a decision on course choices without having to be fully enrolled. Self enrollment is at the discretion of the course leader and may not be available for every course. Where available the key may also be used by students to access courses they are following where there are delays or issues with auto-enrollment. This access is provided to students so that they can make an informed decision regarding their course selection. There might be copyright restrictions to the course material; any use of the course content that is not related to a student's education is not allowed. The material should not be redistributed by students in any circumstances.

Where there is evidence of access to moodle for purposes which are not reasonably linked to a student's personal study on the course the department reserves the right to withdraw this facility on an individual or course basis.

The department explicitly forbids the use of automated tools to "scrape" courses. Access patterns indicative of the use of such tools will result in the removal of access to courses.

The "Archive" moodle should be used by students to review material from earlier in their course, the self-enrollment key is not provided for this purpose.

A key is needed to self-enrol on any course. By using this key, you indicate that you agree with the conditions above.

Enrolment key: cued_moodle_access

You may wish to look at our 'getting started' guide.

Departmental facilities and rules

See the facilities and rules page for information about access to the Department, departmental rules and facilities such as the computer system and The Centre for Languages and Inter-Communication etc.

Dyson Centre

Private engineering project space, training and student team space

The Dyson Centre for Engineering Design (not to be confused with the James Dyson Building) is your space as Engineering Undergraduates, where you can undertake your own private engineering projects and experiments, and a space in which engineering students teams can operate.

The area offers training in use of a variety of machines including lathes, milling machines, laser cutters, and there are also selfservice 3D printers which you can learn how to use.

Various funding sources are available to help you kick start your project and the staff are on hand to offer help and

advice with all aspects of engineering theory, development and design.

For more information see www.dysoncentre.eng.cam.ac.uk

Also of note is Engineering Stores, where a vast range of engineering materials and components are held in stock for immediate purchase, details are available on:

https://www.finance.eng.cam.ac.uk/finance-purchasing/stores