

# M.Sc. in Mathematical Modelling and Scientific Computing

## Dissertation Handbook

2023-24

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## 1 Introduction

All students on the M.Sc. in Mathematical Modelling and Scientific Computing must complete a dissertation in some area of applied mathematics. The dissertation and associated viva voce examination are worth four units and should provide students with an introduction to scientific research.

## 2 How to choose a dissertation topic

Some possible dissertation projects can be viewed at <https://www.maths.ox.ac.uk/members/students/postgraduate-courses/msc-mmsc/dissertation>. The potential dissertation projects will be presented to the students by the supervisors in a meeting in the middle of Hilary Term. This list of projects is not exhaustive and students are encouraged to talk about other ideas to any potential supervisors, which includes most academics or research fellows in OCIAM and the Numerical Analysis Group. Note that the initial supervisor allocated at the beginning of the course will not usually turn out to be the supervisor for the dissertation.

Students are encouraged to talk about potential projects to the supervisors involved in order to help make a decision on which project they would like to do. Students should indicate by the end of Hilary Term which project they would like to do. They should do this by emailing the associated supervisor(s) and the Course Director. The supervisor will confirm within the following week whether the student has been allocated a project. Students may not be offered a project if a supervisor has had too much interest in their projects; there is a limit to how many M.Sc. students one supervisor can supervise. In such a situation the supervisor will make a decision about which students to supervise by having a discussion with each of the students. After this initial allocation of projects, the remaining dissertations will be allocated on a first come first served basis.

## 3 The amount of work involved

A dissertation has a weighting of four units and should therefore be equivalent to all the core courses contributing to the written examinations. Accordingly a student might think of the dissertation as being the equivalent of almost two terms' work. Thus students should expect to spend the majority of Trinity Term and the long vacation working on their dissertation.

## 4 Presentation of dissertation topic to examiners

Each student will be required to give a short talk and to answer questions on the background to their dissertation topic at an open meeting, attended by supervisors and examiners, to be held in late May or early June. Each student will be allocated a 15 minute slot and they should aim to talk for 10 minutes and to allow 5 minutes for questions and discussion. The objectives of the talks are: (a) students get the experience of giving a public presentation; and (b) the examiners

get some idea of the scope of each project and the methods to be used. Students should either prepare slides (recommended) or be prepared to use the whiteboard to describe the problem they are studying, why it is of interest and what techniques will be used to solve the problem.

The presentations are compulsory, however, they do not form part of the assessment and subfusc need not be worn. After the presentations, the Course Director will send students a summary of the feedback given by the examiners and this should be addressed before the submission of the dissertation.

## 5 Submission information

Students should submit a soft copy (pdf file) of their dissertation by the deadline of 12 noon on 28th August 2024. This will then be submitted to the Turnitin plagiarism system. At the time of online submission, students will be required to complete an online declaration. In particular this requires students to confirm that the work contained in the dissertation has not been submitted, wholly or substantially, for a degree of Oxford University, or for a degree of any other institution.

Students should retain a copy of the dissertation for their own use. In particular students should bring their own copy to the viva. After marking, copies of the dissertation will be deposited in the collection and given to the supervisors.

## 6 Supervision

Once a student starts work on their dissertation project in Trinity Term, they should expect to hold regular meetings with their supervisor(s). In the case where a student has more than one supervisor, they may either meet their supervisors individually or together.

Students should discuss the pattern of project supervision with their supervisor(s) at an early stage of the project. Support given by supervisors may be given in meetings or via email. Students should expect to receive one hour of supervision per fortnight as a minimum during term time. There should be further supervision during the long vacation although this may take place online or via email.

In meetings with supervisors, students should expect to update their supervisors on the work they have done since the last meeting, including describing any difficulties encountered. They should expect to receive feedback on this and suggestions for overcoming the difficulties if appropriate. Students may also receive direction to the relevant literature and to receive comments on drafts of their dissertation.

**A complete draft** of the dissertation should be given to the supervisor **at least two weeks prior to submission** in order to allow plenty of time for the supervisor to read and comment on the draft and for changes to be implemented. If the supervisor is likely to be away at this time the student and the supervisor should make alternative arrangements well in advance.

Supervisors will be asked to keep a log of the amount and the nature of the project supervision that they give (see Appendix B) and this will be passed on to the M.Sc. Examiners with the

dissertation. Supervisors will also be asked to propose a 10 mark range for the project and to write a short paragraph justifying this mark range. This information will be available to the M.Sc. Examiners after the vivas and they will use it to help with their final assessment. Beyond this, however, supervisors will have no input on the marking process.

## 7 Format of the dissertation

The final dissertation should usually be 40–50 pages in length (less than 55 pages without penalty) excluding front matter (title page, abstract, acknowledgements, table of contents) and references but including figures and tables. The examiners will enforce the page limit and dissertations submitted which exceed the page limit will be subject to penalties as defined in Table 1. One of the purposes of the page limit is to prevent excessive inclusion of material that is unnecessary for development of the key argument(s) of the dissertation. Further information (e.g. detailed calculations, more detailed data) may be included in appendices. However, whilst examiners are required to consider the main body of the dissertation, whether they read appendices is entirely at their discretion.

Length of dissertation	Penalty (USMs)
55–56 pages	1
57–58 pages	5
59–60 pages	10
61–62 pages	20
63–64 pages	30
65–66 pages	40
67 pages or more	50

Table 1: Penalties for over long dissertations

The dissertation should be typewritten.  $\text{\LaTeX}$  is recommended but it is not compulsory. A 12pt font size should be used. The width of the text should be at most 15cm (6 inches) per page and the height of the text should be at most 22.5cm (9 inches) per page. These width and height requirements will be automatically satisfied by using the OCIAM thesis class for  $\text{\LaTeX}$  which can be downloaded from <https://www.maths.ox.ac.uk/members/it/faqs/latex/thesis-class>. The spacing of the text should be at least one and a quarter spacing which can be achieved with the OCIAM thesis class by using a `baselinestretch` of 1.25.

## 8 Writing mathematics

Since it is the dissertation which is seen and considered by the examiners, its writing should be treated as a substantial part of the work involved and a suitable amount of time should be allocated to it.

Students should put effort into presenting their work as clearly as possible. The paper by Ehrenberg [1] is only 4 pages long and contains good advice on technical writing. Strunk and

White [10] is a guide to writing more generally. Katzoff [3] is an older report on technical writing. The book by Higham [2] gives very good tips on writing mathematics. The book of Krantz [5] is also recommended, as is the older book by Steenrod, Halmos, Schiffer and Dieudonné [9]. Section 1 of Knuth, Larrabee and Roberts [4] is a mini-course on technical writing and there is plenty of good advice in the rest of the book too. The standard reference for L<sup>A</sup>T<sub>E</sub>X is Lamport [6], and an excellent online guide is The Not So Short Introduction to L<sup>A</sup>T<sub>E</sub>X2e [7].

The final dissertation should be a clear and well-reasoned account of the project. It is not necessary to include everything that has been learnt, only what is relevant. There is no point in writing out in great detail things that are well known (references should be used) but the dissertation should be able to be read and understood by the examiners as it stands.

Students should remember that the examiners have to read a lot of dissertations in a short time so it is important to lay the material out clearly. It is possible to look at some past M.Sc. dissertations on the web at <https://www.maths.ox.ac.uk/node/25797> (note that you will have to log in to the website first).

Students should remember to back up all the files relating to their work regularly. This includes not only the codes used to generate results but also the drafts of the dissertation. This will be done automatically for students who are working on the Mathematical Institute computer network.

## 9 Referencing and plagiarism

It is most important that a dissertation is a student's own work and thus all sources should be carefully referenced in order to avoid plagiarism. The University's policy on plagiarism is given at <https://www.ox.ac.uk/students/academic/guidance/skills/plagiarism>.

The London Mathematical Society's advice to its authors [8] gives advice on how to reference the work of others and explains a common referencing system. The conventions for citing internet resources include stating the URL and date accessed.

## 10 Marking of dissertations

The dissertation will be read and marked by two internal examiners, neither of whom is the student's supervisor. The dissertations of a number of students, typically including a selection of those at the pass/fail or merit/distinction borderlines, are also read by the external examiner. The assessors for the viva voce examination will be the examiners who have read the dissertation. The dissertation and viva will be given a combined USM with a weighting of four units. Whilst the dissertation need not necessarily contain original research to pass, the USM will include credit for originality and for performance in the viva.

The final mark for the dissertation and viva will be decided after the viva by the examiners present in the viva, and taking into account comments from any assessors who are not examiners. The examiners are likely to use the mark sheet in the Appendix A to assist with these decisions.

If these examiners are not able to agree a mark initially, there will be a more detailed discussion of the dissertation and viva voce examination which will lead to an agreed mark with the input of other examiners if necessary.

The examiners will give credit for qualities such as content, mathematics and presentation. Here is a brief explanation of these terms:

- **Content:** the examiners are looking for some of a student's own thoughts and contributions: students must do more than rehash text books and lecture notes; they should use original sources and must not plagiarise.
- **Mathematics:** proofs and assertions should be correct, and the mathematics should be appropriate for the level of study. In applied topics, the derivation of the model should be properly justified.
- **Presentation:** the mathematics must be clear and well laid out; the English should be clear and grammatically correct; sources should be properly acknowledged, references should be properly cited. Students should give some thought to notation, choice of typeface, and numbering of equations and sections and the pages should be numbered. Students should be sure to supply complete and accurate references for all the sources used in completing the project, and be sure to cite them properly in the text.

There is always a risk that a project might not succeed, especially if the original plan had involved significant original research. Although this is a rare occurrence, examiners are aware of the possibility. They accept that a well-written account of the work done, with an explanation of why the original aims were not met, can nevertheless be worthy of high credit.

At the same time as the dissertation is submitted, the supervisor shall submit to the Chair of the Examiners a confidential report, which includes a record of meetings with the candidate, the purpose of which is to assist the examiners to determine how much assistance the candidate has received in the preparation of the dissertation; this report will be on a form supplied for the purpose by the Course Director and will be used to assist the examiners in decisions about borderline candidates.

The internal examiners for the academic year 2023–24 are Professor Coralia Cartis (Chair), Professor Ruth Baker, Professor Peter Howell, and Professor Yuji Nakatsukasa. The external examiner will be Professor Katerina Kaouri from the University of Cardiff.

## 11 Viva voce examinations

The viva voce examinations will be held in mid-September. Each viva lasts for half an hour. All students (and internal examiners) must wear sub fusc. Students should expect at least two examiners to be present at the viva; these will be the examiners who have already read and assessed the dissertation. Students should bring a copy of their dissertation with them and be prepared to use the whiteboard if necessary. Questions in the viva tend to concentrate on the dissertation but the examiners may also ask questions about any other part of the course. The

examiners will start by asking each student to describe in 5 minutes the aims and results of their dissertation and students are encouraged to prepare 3–5 slides to help with this.

## 12 Late submission of coursework

Late submission of coursework is a serious matter and will usually result in academic penalties unless prior permission for late submission has been given by the Proctors. In the absence of such Proctorial permission, the academic penalties will be as set out in Table 2. In addition, all late submissions of dissertations will be reported to the Proctors who will conduct an investigation into the reason for the late submission and a late submission fee will be charged.

Lateness	Penalty (USMs)
Up to 4 hours	1
4–24 hours	5
24–48 hours	10
48 hours – 5 days	20
5–6 days	30
6–7 days	40
more than 7 days	fail (mark of 0 awarded)

Table 2: Academic penalties for late submissions

## 13 Archiving of dissertations

The Course Director will keep a copy of each dissertation for the archive and a copy will be given to the supervisor.

## 14 Class descriptors

Qualitative class descriptors for the levels of performance are summarised below.

**Distinction:** High quality work. The candidate shows excellent problem solving skills and excellent knowledge of the material, and is able to use that knowledge innovatively and/or in unfamiliar contexts.

**Merit:** The merit shows very good quality of work throughout the course. Candidates who achieve a merit will have demonstrated very good problem solving skills and knowledge over a wide range of topics, or excellent command of some material and good command of the rest.

**Pass:** The pass covers a wide range of results from candidates who show basic problem solving skills and adequate knowledge of most of the material to candidates who show good or very good problem-solving skills, and good or very good knowledge of much of the material over a wide range of topics.



**Fail:** The candidate shows inadequate grasp of the basic material. Candidates may have shown some understanding but the majority of work is likely to show major misunderstanding and confusion, and/or inaccurate calculations.

## 15 Criteria for USMs

**90–100:** The candidate shows remarkable ability and true insights. The dissertation shows considerable evidence of original thought and is very well presented with no important deficiencies. Dissertations in this band will be likely to be worthy of publication without the need for further mathematical investigation and without the need for significant re-writing of the text.

**80–89:** Work in this range will be at the level of a strong candidate for a DPhil applicant. It will have depth, accuracy and a clear focus. It will show a strong command of material at least at the MSc level. It is likely to contain original material, which may take the form of new mathematical propositions, new examples, or new calculations, for example.

**70–79:** The candidate shows excellent problem-solving skills and excellent knowledge of the area of their dissertation. The dissertation shows evidence of original thought and is well presented.

**60–69:** The candidate shows a strong overall performance but with some weaknesses. Typically the work has been carried out and presented and analysed reasonably well, especially at the merit level.

**50–59:** The candidate has performed satisfactorily but there are weaknesses in the dissertation. Although there will be some good work in the dissertation, typically there will be some flaws and there will be little evidence of originality.

**40–49:** The candidate has not performed satisfactorily. Although there may be some good work in the dissertation, either there will be significant errors or the content will be insufficient.

**30–39:** The candidate has performed poorly. There need not be any good quality work in the dissertation, but there will be indications of some competence.

**0–29:** A dissertation in this band is likely to contain little or no meaningful content.

## 16 Problems and complaints

Responsibility for the project lies with the student and students should be proactive in seeking support and guidance as the dissertation is completed. Students who experience any problems with their project at any point should ensure they discuss this with somebody as soon as possible. If they feel unable to approach their supervisor, they should contact their college tutor, the Course Director or one of the academic administration team in the first instance.

If a student wishes to make a formal communication to the examiners relating to their dissertation, then it must be stressed that in order to preserve the independence of the examiners, they are not allowed to make contact directly. Any communication must be via the Senior Tutor of their college, who will, if he or she deems the matter of importance, contact the Proctors. The Proctors in turn communicate with the Chair of Examiners. Students who have any queries

about the examinations or anything related to the examinations, for example, illness, personal issues, should not hesitate to seek further advice from their college tutor, from the Course Director or from one of the department's academic support staff.

## References

- [1] A. S. C. Ehrenberg, *Writing Technical Papers or Reports*, The American Statistician **36** (1982), no. 4, 326–329. <http://www.jstor.org/stable/2683079?origin=JSTOR-pdf>.
- [2] N.J. Higham, *Handbook of Writing for the Mathematical Sciences*, SIAM, 1998.
- [3] S. Katzoff, *Clarity in Technical Writing*, Second Edition, NASA, 1964. [https://archive.org/details/nasa\\_techdoc\\_19640016507](https://archive.org/details/nasa_techdoc_19640016507).
- [4] D. E. Knuth, T. Larrabee, and P. M. Roberts, *Mathematical Writing*, Mathematical Association of America, 1989. Available at <http://tex.loria.fr/typographie/mathwriting.pdf>.
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- [6] L. Lamport, *L<sup>A</sup>T<sub>E</sub>X: A Document Preparation System*, Second Edition, Addison Wesley, 1994.
- [7] T. Oetiker, H. Partl, I. Hyna, and E. Schlegl, *The Not So Short Introduction to L<sup>A</sup>T<sub>E</sub>X2<sub>ε</sub>*. <http://www.ctan.org/tex-archive/info/lshort/english/lshort.pdf>.
- [8] Sue Rodd and Ola Törnkvist, *Journals of the London Mathematical Society: house style and instructions for copy-editors and typesetters*. <http://www.lms.ac.uk/sites/lms.ac.uk/files/Publications/LMSHouseStyle.pdf>.
- [9] N. E. Steenrod, P. R. Halmos, M. M. Schiffer, and J. R. Dieudonné, *How to Write Mathematics*, American Mathematical Society, 1973. Second Edition, 1981.
- [10] W. Strunk Jr. and E. B. White, *The Elements of Style*, Fourth Edition, Longman, 1999. Available at <http://www.bartleby.com/141/>.

**Appendix A Examiners' mark sheet**



## **M.Sc. in Mathematical Modelling and Scientific Computing**

### **Feedback on Dissertation and Viva Voce Examination**

**Name of Candidate:**

**Title of Dissertation:**

**Names of Assessors:** Ruth Baker, Coralia Cartis, Peter Howell, Yuji Nakatsukasa, Katerina Kaouri

**Formulation of the problem** (Problem background, problem/mathematical formulation, technical difficulty of the problem)

**Analysis of the problem** (Numerical formulation, mathematical analysis of problem, numerical analysis of problem, quality of results, originality)

**Presentation of dissertation** (Clarity of presentation, typographical accuracy)

**Viva voce examination** (Verbal description of work, response to questions, clarification of ambiguities, knowledge of area of dissertation)



## M.Sc. in Mathematical Modelling and Scientific Computing

### Assessment of Dissertation and Viva Voce Examination

#### Name of Candidate:

Cross out any lines that are not relevant, for example, a dissertation with no asymptotic or other analysis may not use the line "Mathematical analysis of problem".

#### Dissertation

Problem background	Weak	Moderate	Good	Excellent
Problem/Mathematical formulation	Weak	Moderate	Good	Excellent
Technical difficulty of problem	Low	Moderate	Tricky	Hard
Numerical formulation	Weak	Moderate	Good	Excellent
Mathematical analysis of problem	Weak	Moderate	Good	Excellent
Quality of results	Weak	Moderate	Good	Excellent
Originality	Weak	Moderate	Good	Excellent
Matching of outcome to objective	Poor	Satisfactory	Good	Excellent
Clarity of presentation	Weak	Moderate	Good	Excellent
Typographical accuracy	Poor	Satisfactory	Good	Excellent
<b>Range for dissertation mark</b>	<b>&lt;50</b>	<b>50-60</b>	<b>60-70</b>	<b>&gt;70</b>

#### Viva Voce Examination

Verbal description of work	Weak	Moderate	Good	Excellent
Responses to questions	Weak	Moderate	Good	Excellent
Clarification of ambiguities	Weak	Moderate	Good	Excellent
Knowledge of area of dissertation	Weak	Moderate	Good	Excellent
<b>Range for viva mark</b>	<b>&lt;50</b>	<b>50-60</b>	<b>60-70</b>	<b>&gt;70</b>

Suggested mark:

**Appendix B Supervisor's log**

# SUPERVISOR'S LOG

M.Sc. in Mathematical Modelling and Scientific Computing Dissertation

Supervisor's name: .....

Candidate's name: .....

Title of dissertation:.....

Please give details of supervision provided below.

Date and Time	Nature of supervision/guidance