

Department of Physics and Department of Mathematics

Examination Conventions 2016-2017

Masters in Mathematical and Theoretical Physics (MMathPhys)

MSc in Mathematical and Theoretical Physics (MScMTP)

1 Introduction

This document sets out the examination conventions for the **Masters in Mathematical and Theoretical Physics (MMathPhys)** and the **MSc in Mathematical and Theoretical Physics (MScMTP)** in accordance with the regulations for these courses. This document explains how work will be marked and how the final degree classification will be derived from these marks.

2 General Structure of the Examination

All courses in this programme either have a component of formal assessment - through written invigilated exams, take-home exams or mini-projects - or a homework completion requirement. Some courses may be offered with a combination of formal assessment and homework requirement. Any course with a component of formal assessment will be referred to as a formally assessed course. The table in Appendix A specifies which courses are formally assessed and by which method and it indicates which courses have a homework completion requirement.

Students are required to undertake at least ten units within the programme, where one unit corresponds to a 16-hour lecture course. This means that a 16-hour lecture course counts as one unit, while, for example, a 24 hour lecture course counts as 1.5 units. More specifically, students are required to offer

- (a) at least four units that are assessed by written invigilated exams
- (b) at least further three units that are formally assessed by written invigilated exams or in other ways (see section 3)
- (c) at least three other units (which may be from courses with homework completion requirement only or from formally assessed courses)
- (d) an oral presentation

A dissertation replaces one, in the case of an extended dissertation two, of the units in (b) or (c). There are no other formal constraints on course choices and students are otherwise free to design their own pathways (although paying close attention to the guidance offered is strongly recommended). Please note that it is a student's responsibility to ensure that she/he fulfils the requirements for the overall number of units and the number of formally assessed units.

3 Assessment Types

Formally assessed courses will be assessed by one or more of the following means:

- invigilated written examinations;
- “take-home” examinations;
- mini-projects

The modes of assessment for all courses will be published at the beginning of each academic year and are detailed in Appendix A. In addition, lecture courses may have a homework requirement and these courses are indicated in Appendix A.

Certain lecture courses offered within the MMathPhys/MscMTP are Part B or Part C courses within the MMath programme. The examinations for these courses are the responsibility of the Part B or Part C Mathematics Examiners and follow the rules set out in the *Department of Mathematics Examination Conventions 2016-2017*. Students taking Part B papers at the level of the MMathPhys/MScMTP will be required to complete an additional assignment. Further information is included below.

3.1 Invigilated Written Examinations

The duration of written examinations will normally be 1.5 or 2 hours for a 16-hour lecture course and 3 hours for a 24-hour lecture course. Examination papers will typically consist of three (four) questions for 16-hour (24-hour) lecture courses, each worth 25 marks. The date of each exam and the paper rubrics are given in the table in Appendix A.

The questions set will, as a whole, be fairly spread across the syllabus. Questions will typically begin by examining material explicitly covered in the course, followed by a part which tests understanding. Written examinations will be marked by a single assessor according to pre-agreed model solutions and marking scheme. The examination scripts are then checked by an independent checker to ensure that all work has been marked, and that the marks have been correctly totalled and recorded.

3.2 Take Home Examinations

Some courses will be assessed, or partially assessed, by take home exams. These are written examinations, which students are expected to complete at home over a 48-hour period. Students are allowed to use books, but must not discuss the exam with anybody else. Take home exams will normally be marked by a single assessor, according to pre-agreed model solutions and marking scheme. The examination scripts are then checked by an independent checker to ensure that all work has been marked, and that the marks have been correctly totalled and recorded.

3.3 Mini-projects

Mini-projects are normally set by the course lecturer. Mini-projects set for courses in MT or HT will be released to candidates on Monday, week 8 of term, and the submission deadline will be noon on Monday, week 11 of that same term. Mini-projects set for courses in TT will be released to candidates on Monday, week 6 of term, and the submission deadline will be noon on Monday, week 9 of term.

Mini-projects will be double-blind marked, normally by the course lecturer and one other assessor. The marks of the two assessors will be reconciled following the standard procedure detailed in Appendix B. The exception to this is that mini-projects which have pre-agreed model solutions and marking scheme will be marked by a single assessor. The mini-projects will then be checked by an independent checker to ensure that all work has been marked, and that the marks have been correctly totalled and recorded.

3.4 Courses with homework requirement

Some courses require that homework is completed to a certain standard in order to complete the course. There are two types of such courses:

- courses with formal assessment (an invigilated written examination, a “take-home” examination or a mini-project) **and** a homework component that needs to be completed, and
- courses without formal assessment (mostly some more advanced courses taught in HT and TT) but with a requirement for homework completion.

This sub-section describes homework completion requirements for both types of courses. Note that courses from Part B or Part C of the MMath or MPhys programmes do not have a homework completion requirement. The table in Appendix A indicates the assessment method for every course and whether or not the course has a homework completion requirement.

The homework for all courses with homework requirement will be assigned by the lecturer of the course. Each homework will be marked by a teaching assistant (TA) based on solutions provided by the lecturer. Some of the courses will be accompanied by classes led by tutors in order to discuss the homework assignments. The homework problems will be marked using a letter system A/B/C for problems solved or attempted competently (A for excellent, B good, C fair), and F for those problems which are not handed in or, if attempted, show insufficient understanding of the concepts taught in the lectures. The TA will record the mark of each problem and return the marked scripts as promptly as possible. The students receive feedback on their solutions from the class tutor, whenever there is one, or from the marking by the TA who sometimes may choose to leave constructive comments on the script.

The homework requirement for a course has been completed if 50% or more of all the problems assigned have a mark A/B/C. Otherwise the homework requirement has not been completed. The TA will scan all questions marked F. At the end of the course, Examiners will review all questions assigned F and will make the final decision as to whether or not each student has completed the homework requirement for a unit.

Each homework will have a submission date. Late homework will only be accepted in exceptional circumstances. Students who fall ill or have an emergency which prevents them from handing in their homework on time, need to contact their lecturer, as soon as possible. For those courses accompanied by classes which discuss the homework assignments, homework submitted after a student has attended the class will not be accepted. The course handbook provides further details on the procedure to follow if you are unable to meet the submission date for homework, and the procedure to follow if you wish to make a complaint.

3.5 Oral Presentation

All students are required to give an oral presentation on a specialist topic in Trinity Term. The presentation will be assessed on a pass/fail scale by the Examiners.

The oral presentations will be organised by a co-ordinator appointed by the Joint Supervisory Committee for the MMathPhys/MScMTP. A list of available topics will be published at the beginning of Hilary Term. Students undertaking a dissertation must give their oral presentation on the subject of their dissertation. Students may also approach the coordinator to propose their own topics.

3.6 Courses from the MMath Part B programme

Some lecture courses offered within the MMathPhys/MscMTP may be Part B (third year undergraduate) courses within the MMath programme. As mentioned before, the examinations for these courses are the

responsibility of the Part B Mathematics Examiners and follow the rules set out in the *Department of Mathematics Examination Conventions 2016-2017*. No more than three Part B courses can be counted towards the 10 required units.

For any part B course to be completed at the level of the MMathPhys/MScMTP programme, students will be required to complete an extra assignment which will be more searching than the exam questions. The extra assignment for each Part B course offered within the MMathPhys/MScMTP programme is described in the handbook.

Note also that an MMathPhys student is not allowed to retake Part B courses they took in the third year.

4 Dissertation

Each dissertation will be offered and supervised by a dissertation supervisor. Dissertations will normally be marked by the dissertation supervisor and blind-marked by one other assessor. The marks of the two assessors will be reconciled following the procedure detailed in Appendix B. A standard dissertation counts for one unit. Subject to agreement by the dissertation supervisor, candidates can also opt for an extended dissertation with a wider scope which counts for two units.

The assessors of a dissertation that, in their view, shows particular originality and/or insight may recommend to the Examiners that this dissertation be given a commendation.

The submission deadline for dissertations is noon on Monday, week 5 of Trinity Term.

5 Penalties for Late Submission

The Examination Regulations stipulate specific dates for submission of dissertations, take-home exams and mini-projects. Rules governing late submission and any consequent penalties are set out in full in the *Late submission and non-submission of a thesis or other written exercise* subsection of the Regulations for the Conduct of University Examinations section of the Examination Regulations 2016.

Candidates prevented by illness or other urgent causes from submitting a dissertation, a take-home exam or a mini-project on time should ask their college to submit an application for an extension to the Proctors on their behalf.

If the Proctors grant permission to submit work late under clause 1 of paragraph 14.7 (Examination Regulations), no penalty will be applied.

Work submitted late without prior permission may still be accepted for assessment under paragraph 14.9 or 14.10 (Examination Regulations), but the Examiners may apply a penalty of a reduction in the mark for the work (see the table below). Candidates are advised to inform their college tutor of any mitigating circumstances as soon as possible, so that the college can make an application to the Proctors if appropriate.

Table 1: Late Submission Tariff

Lateness	Penalty
Up to 4 hours	1%
4–24 hours	10%
24–48 hours	20%
48–72 hours	30%
72–96 hours	40%
96+ hours	50%

Note: The penalty will be a percentage reduction of the maximum total mark available for the work so, for example, in the case of a 10% penalty, 10 University standardised Marks (USMs) would be deducted. The final mark awarded after application of the penalty cannot be below 0.

Students are advised that, according to the University's Examination Regulations, the University applies a late fee to any work covered in this section which is handed in late.

6 Plagiarism

Candidates are reminded of the importance of avoiding any suspicion of plagiarism, please see <http://www.ox.ac.uk/students/academic/guidance/skills/plagiarism> for further guidance. Depending on their severity, cases of suspected plagiarism may be referred to the Proctors for investigation or may be dealt with by the board of examiners. If dealt with by the board of examiners as a case of poor academic practice, the examiners may deduct marks (for lack of adequate referencing, poor use of citation conventions etc) of up to 10% of the marks available for the assessment. Where the consequence of the marks deduction would result in failure of the assessment and of the programme the case must be referred to the Proctors.

7 Analysis of Marks

The Examiners will assign USMs for each unit of assessment undertaken by a student and may rescale the raw marks in order to arrive at the USM reported to students. When considering whether to scale the raw marks for a particular unit, the Examiners will take into consideration:

- the relative difficulty of the unit compared to the other units in the programme;
- the report submitted by the assessor who set and marked the unit.

The board of Examiners will use their academic judgement to ensure that appropriate USMs are awarded and may use further statistics to check that the marks assigned fairly reflect the candidates' performances. It is expected that scaling will be achieved by a piecewise linear mapping of the percentage class boundaries onto the USM scheme. More details of the scaling algorithm will be detailed in the Examiner's report.

8 MMathPhys/MScMTP Degree Classification

Outcomes for all courses with assessment will be published as USMs. The object of the USMs is to allow direct comparison between the results of examinations in different subjects. The correspondence between USM ranges and classes is given below in Section 8.1.

A course with formal assessment is considered completed if the USM of the course is $\geq 50\%$ and if any homework requirement has been completed. A course with no formal assessment is considered completed if the homework requirement has been completed.

The \overline{USM} is calculated as described in Appendix C. The overall MMathPhys/MScMTP degree classification is as follows:

- A *Distinction* will be awarded if all of the following conditions are satisfied.

- i) The candidate offers at least 10 units. These must contain at least 7 formally assessed units of which at least 4 units have a written invigilated exam.
 - ii) At least 10 units have been completed. In exceptional circumstances, the examiners may relax this requirement.
 - iii) $\overline{USM} \geq 70$
 - iv) The oral examination has been passed.
- A *Pass* will be awarded if all of the following conditions are satisfied.
 - i) The candidate offers at least 10 units. These must contain at least 7 formally assessed units of which at least 4 units have a written invigilated exam.
 - ii) At least 8 units have been completed. In exceptional circumstances, the examiners may relax this requirement.
 - iii) $\overline{USM} \geq 50$
 - iv) The oral examination has been passed.
 - v) The candidate does not qualify for a distinction.
 - A candidate not meeting either of the above will be deemed to have *Failed*.

The Examiners will use their academic judgement to ensure a fair outcome for all candidates, and to produce a consistent ranked list of candidates according to the classification scheme above.

Master of Mathematical and Theoretical Physics A student on the Master of Mathematical and Theoretical Physics course who satisfies the Examiners may supplicate for the degree of Master of Mathematical and Theoretical Physics with the above associated classification for Part C; additionally their transcript will show the classification for Parts A and B as previously assigned by the Part B Examiners in the subject in which he or she sat those parts.

MSc in Mathematical and Theoretical Physics A student on the MSc in Mathematical and Theoretical Physics course who satisfies the Examiners may supplicate for the degree of MSc in Mathematical and Theoretical Physics with the above associated classification.

8.1 Class Descriptors

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

- **Distinction:** High quality work throughout the course. The candidate shows excellent knowledge of the material over a wide range of topics. The criteria for USMs in the distinction band are:
 - 90-100: The candidate shows remarkable ability and true insights. Dissertations in this band will be worthy of publication.
 - 80-89: The candidate shows outstanding problem-solving skills and outstanding knowledge of the material over a wide range of topics, and is able to use that knowledge innovatively and/or in unfamiliar contexts.
 - 70-79: The candidate shows excellent problem-solving skills and excellent knowledge of the material over a wide range of topics, and is able to use that knowledge innovatively and/or in unfamiliar contexts.

- **Pass:** The pass covers a wide range of results from candidates who show adequate knowledge of most of the material, to candidates who show good or very good knowledge of much of the material over a wide range of topics. The criteria for USMs in the pass band are:
 - 60-69: The candidate shows good or very good problem-solving skills, and good or very good knowledge of much of the material over a wide range of topics.
 - 50-59: The candidate shows basic problem solving skills and adequate knowledge of most of the material.
- **Fail:** The candidate shows an 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.
 - 40-49: The candidate shows reasonable understanding of at least part of the basic material and some problem solving skills. Although there may be some good work, the majority of work will contain errors in calculations and/or show incomplete understanding of the topics.
 - 30-39: The candidate shows some limited grasp of basic material over a restricted range of topics, but with large gaps in understanding. There need not be any good quality work, but there will be indications of some competence.
 - 0-29: The candidate shows an inadequate grasp of the basic material. The work is likely to show major misunderstanding and confusion, and/or inaccurate calculations.

9 Alternative Arrangements

Students with special examination needs (for example Specific Learning Difficulties) may apply to the Proctors through the Senior Tutor of his or her college

- for alternative examination arrangements relating to his or her condition and/or
- for the condition to be taken into account by the Examiners as a special factor which may affect his or her performance in examinations.

Further details on the general rules can be found in the University Examination Regulations and at <http://www.ox.ac.uk/students/academic/exams/arrangements>.

9.1 Resits

A student on the Master of Mathematical and Theoretical Physics course who fails to satisfy the Examiners may retake Part C on at most one subsequent occasion, not later than one year after the initial attempt.

A student on the MSc in Mathematical and Theoretical Physics who fails to satisfy the Examiners may retake the examination on at most one subsequent occasion, not later than one year after the initial attempt.

In all such cases the Examiners will specify at the time of failure which components may or must be redone.

9.2 Factors Affecting Performance

The board of Examiners will use the following procedure for the consideration of medical and other special circumstances transmitted to them via the Examinations and Assessments Section:

- (a) A subset of the board will meet to discuss the individual applications and band the seriousness of each application on a scale of 1-3 with 1 indicating minor impact, 2 indicating moderate impact, and 3 indicating very serious impact. When reaching this decision, Examiners will take into consideration the severity and relevance of the circumstances, and the strength of the evidence. Examiners will also note whether all or a subset of papers were affected being aware that it is possible for circumstances to have different levels of impact on different papers.
- (b) The banding information will be used at the final board of Examiners meeting to adjudicate on the merits of candidates.
- (c) A brief, formal record will be kept confirming (i) the fact that information about special circumstances has been considered by the Examiners, (ii) how that information has been considered, and (iii) the outcome of the consideration with the reasons for the decisions reached.

Further information on how to make an application for consideration of factors affecting performance in an examination is available at <http://www.ox.ac.uk/students/academic/exams/guidance>.

10 Formative Feedback

Students will receive feedback on non-examined work through comments on the problem sheets they complete for the classes accompanying lecture courses. Specifically, courses in MT will normally have homework assignments which are marked, returned to the students and discussed in exercise classes.

11 Examiners for 2016-2017

The internal Examiners are:

Prof. John Chalker, Prof. Xenia de la Ossa, Prof. Andre Lukas, Prof. James Sparks.

The external Examiners are:

Prof. Daniel Waldram, Professor of Theoretical Physics, Imperial College, London

Prof. Gordon Ogilvie, Professor of Mathematical Astrophysics, University of Cambridge

Candidates must not make direct contact with the Examiners regarding any matter relating to examinations. Any communication must be via the Senior Tutor of the respective candidate's college or the Director of Studies, who will, if appropriate, contact the Proctors. The Proctors in turn communicate with the Chair of Examiners.

Appendices

A Assessment Methods by Course 2016–17

Michaelmas Term

Unit	Assessment Method	Assessment Instruction	Assessment Date	Submission Deadline	Homework Requirement	units
Quantum Field Theory	3h inv. exam	answer 3 questions	wk 0 HT	N/A	no	1.5
Statistical Mechanics	1.75h inv. exam	best 2 questions count	wk 6–8 TT	N/A	no	1
Advanced Quantum Theory	2h inv. exam	answer 2 questions	wk 6–8 TT	N/A	no	1.25
Noneq. Stat. Physics	1.5h inv. exam	answer 2 questions	wk 6–8 TT	N/A	yes	1.5
Topological Quant. Theory	no formal assessment	N/A	N/A	N/A	yes	1
Kinetic Theory	3h inv. exam	answer 3 questions	wk 0 HT	N/A	no	1.5
Radiative Proc. & High Energy Astro	Take-home-exam		exam released Sat wk 8 TT*	12noon, Tue wk 9 TT	yes	1.25
General Relativity I	1.75h inv. exam	best 2 questions count	wk 6–8 TT	N/A	no	1
Perturbation Methods	1.75h inv. exam	best 2 questions count	wk 6–8 TT	N/A	no	1
Num. Linear Algebra	1.75h inv. exam	best 2 questions count	wk 6–8 TT	N/A	no	1
Groups and Repr.	3h inv. exam	answer 3 from 4 questions	wk 0 HT	N/A	yes	1.5
Algebraic Topology	1.75h inv. exam	best 2 questions count	wk 6–8 TT	N/A	no	1
Algebraic Geometry	1.75h inv. exam	best 2 questions count	wk 6–8 TT	N/A	no	1
Differential Geometry	1.75h inv. exam	best 2 questions count	wk 6–8 TT	N/A	no	1

**The take-home-exam for this course will be released at the same time as the start of the C1 MPhys exam. This is likely to be Saturday of week 8 but the MPhys examination timetable will not be confirmed until the Easter vacation. The release date of this exam is subject to confirmation until then.*

Hilary Term

Unit	Assessment Method	Assessment Instruction	Assessment Date	Submission Deadline	Homework Requirement	units
Adv. Fluid Dyn.	2h inv. exam	answer 2 questions	wk 0 TT	N/A	no	1
Soft Matter Physics	no formal assessment	N/A	N/A	N/A	yes	1
Adv. QFT for Part. Phys.	3h inv. exam	answer 3 questions	wk 0 TT	N/A	no	1.5
Quant. Matter	2h inv. exam	answer 2 questions	wk 6-8 TT	N/A	yes	1
String Theory I	Mini-project		proj. released Mo, wk 8 HT	12noon, Mo, wk 11 HT	no	1
Networks	Mini-project		proj. released Mo, wk 8 HT	12noon, Mo, wk 11 HT	no	1
Collisionless Plasma Physics	Take-home. exam		exam released Mo, wk 9 HT	12noon, Wed, wk 9 HT	no	1
Supersymm. and SUGRA	3h inv. exam	answer 3 questions	wk 0 TT	N/A	no	1.5
Galactic & Planetary Dyn.	Mini-project		proj. released Mo, wk 8 HT	12noon, Mo, wk 11 HT	no	1
Geophys. Fluid Dynamics	2h inv. exam	answer 2 questions	wk 0 TT	N/A	no	1
Astrophysical Gas Dynamics (continues in TT)	Take-home exam		exam released Wed, wk 8 TT	12noon, Fri, wk 8 TT	yes	1.25
Intro to Quant. Info.	1.75h inv. exam	best 2 questions count	wk 6-8 TT	N/A	no	1
General Relativity II	1.75h inv. exam	best 2 questions count	wk 6-8 TT	N/A	no	1
Cosmology	no formal assessment	N/A	N/A	N/A	yes	1
Non-pert. Methods in QFT (continues in TT)	no formal assessment	N/A	N/A	N/A	yes	1
Applied Compl. Variables	1.75h inv. exam	best 2 questions count	wk 6-8 TT	N/A	no	1
Geometric Group Theory	1.75h inv. exam	best 2 questions count	wk 6-8 TT	N/A	no	1

Trinity Term

Unit	Assessment Method	Assessment Instruction	Assessment Date	Submission Deadline	Homework Requirement	units
Conf. Field Theory	no formal assessment				yes	1
Intro to Gauge-String Duality	no formal assessment	N/A	N/A	N/A	yes	1
Topics in Soft and Active Matter Phys.	no formal assessment	N/A	N/A	N/A	yes	0.5
String Theory II	no formal assessment	N/A	N/A	N/A	yes	1
The Standard Model	no formal assessment	N/A	N/A	N/A	yes	1
Topics in Quantum CMP	no formal assessment	N/A	N/A	N/A	yes	0.5
Beyond the Standard Model	no formal assessment	N/A	N/A	N/A	yes	1
Collisional Plasma Physics	Take-home exam		exam released Tue, wk 9 TT	12noon, Thur wk 9 TT	no	1
Astroparticle Physics	no formal assessment	N/A	N/A	N/A	yes	1
QFT in Curved Space-Time	no formal assessment	N/A	N/A	N/A	yes	1

B Reconciliation Procedure

The Examiners will follow the procedure below when reconciling marks for assessments which are double-blind marked.

1. The two assessors each read the assessment; the assessors independently write reports and produce preliminary marks.
2. If the reports are broadly in agreement, and the two assessor marks differ by no more than 10 marks, the Examiners can take the average of the two marks as the provisional mark. In these circumstances the Examiners will normally inform the assessors that they intend to do this and give the assessors a chance to object.
3. If (2) does not apply then the Examiners will ask the assessors to confer on the standard of the work, with a view to agreeing a mark. Email discussions may be enough in simple cases, providing nothing is said that breaches exam security. The focus will be on identifying the reasons for any difference in the proposed marks. An extreme example might be that X noticed a catastrophic error in the proof of the main theorem, but Y did not spot it.
4. If the two assessors agree on a mark under (3), they report the agreed mark to the Examiners who will normally take the agreed mark as the provisional mark.
5. If the two assessors cannot agree under (3), they send a summary of the discussion in (3) to the Examiners. The Examiners will appoint a third assessor who will independently assess the project before receiving the marks from the other assessors and the supervisor. The third assessor will make a recommendation to the Examiners.

C Calculating the \overline{USM}

Let $\{c_1, \dots, c_n\}$ be the set of formally assessed courses a student has offered. For each of these courses c_i , the number of units of the course is denoted by u_i , the number of units assessed by a written invigilated exam by w_i (zero if the course does not have a written invigilated exam) and the USM achieved by m_i . For a subset of these courses, given by an index set $S \subset \{1, \dots, n\}$, we define the total number of units, $|S|$, the total number of units with written invigilated exam, $\|S\|$, and the average USM, \bar{S} , of this subset by

$$|S| = \sum_{i \in S} u_i, \quad \|S\| = \sum_{i \in S} w_i, \quad \bar{S} = \frac{1}{|S|} \sum_{i \in S} u_i m_i.$$

The \overline{USM} is then given by

$$\overline{USM} = \max_{S: |S| \geq 7 \text{ and } \|S\| \geq 4} (\bar{S}).$$