CONFIDENTIAL

EXAMINERS' REPORTS 2020
MATERIALS SCIENCE (MS)

Internal Examiners' Reports

REPORT ON FINAL HONOURS SCHOOL OF MATERIALS SCIENCE, PART I EXAMINATION

Part I

A. STATISTICS

(1) **Numbers and percentages in each category**

The Part I Examination in Materials Science is unclassified. No distinctions are awarded.

Category	Number			Percentage		
	2019/20	2018/19	2017/18	2019/20	2018/19	2017/18
Distinction	n/a	n/a	n/a	n/a	n/a	n/a
Pass	30	33	32	100	100	100
Fail	0	0	0	0	0	0

(2) **If vivas are used**
As stated in the Examination Conventions, vivas are not used in the Part I examination.

(3) **Marking of scripts**
All scripts were double-blind marked by the Examiners and Assessors. The full procedures are described in the Examination Conventions.

B. NEW EXAMINING METHODS AND PROCEDURES

Because of the Covid-19 pandemic and the consequent restrictions on gatherings, the 2020 FHS exams were profoundly altered with respect to any previous year.

Scheduling:
Uniquely, the 2020 Part I examinations took place in Michaelmas term rather than the preceding Trinity as would be normal. Consequently it was necessary for students to embark on their Part II projects early, and then pause them in order to prepare for and sit the exams. This rescheduling was an emergency measure in response to the uncertainty over the developing pandemic; in summer the University felt that there was the possibility that delaying exams might yet have the benefit that they could be held in traditional Exam Schools format. In actuality, rather as the Department had anticipated, the delay did not result in this outcome. However, while the alteration of schedule was without benefit to the students, there was the minor advantage to the examiners that the Part I marking was separate from Part II marking, thus lowering peak workload and making it practical to assimilate the new approaches and technology.

Open book format:
In line with other Oxford exams in 2020, the Materials FHS Part I papers were sat remotely by students without supervision. The timed release of papers, and the necessity for students to submit their completed scripts, was handled centrally by the University. Students were free to use all resources to-hand, including their own notes and of course the internet, with the obvious limitation that they could not consult anyone for advice nor plagiarise any source. Students were given an additional hour to submit their work in the form of digital images of the pages of their hand-written scripts; students whose circumstances merited additional time had correspondingly extended submission deadlines. Penalties would potentially be applied in the event that a student missed the deadline by more than a modest margin, however in fact (after investigation of one unclear case) no such penalties were applied in Part I.
As exam papers had been initially prepared before the pandemic, it was necessary for Examiners to adapt or ‘triage’ the papers into an open book compatible form. This was done with the valuable assistance of the External Examiners and was broadly successful; further comments are in Part C immediately below.
Among the consequences of the new model, students were unable to query any typo or error that they might feel existed in a paper; instead they were instructed to note in their scripts so that

examiners could account for any such remarks when marking. In fact, there was only one significant typo over all 6 papers; GP2 had an error in an equation but as noted in the Report on that paper, markers felt well-able to correct for this error.

Digital marking and no-scaling
Students uploaded images of the hand-written scripts which were then available to markers via secure WebLearn within a couple of days. Marking then proceeded analogously to practice in previous years, i.e. double-blind marking and subsequent reconciliation of the mark sheets (via Teams sessions). A notable alteration was that, whereas in prior years the paper scripts could not be annotated by examiners (except for initialling the corners of pages), since the examiners had access to digital versions they were free to annotate them as they wished. This proved useful during mark reconciliation where markers could see their own annotations as a reminder of the rational for a given mark. All digital materials held by examiners were securely deleted from the end of the marking process.
In order to address concerns of students, a commitment was made ahead of the exams that no paper would be globally marked down. In fact, the examiners did not face a situation where they would have wished to scale down any paper even if the year had been a normal one.

C. CHANGES IN EXAMINING METHODS, PROCEDURES AND CONVENTIONS WHICH THE EXAMINERS WOULD WISH THE FACULTY AND THE DIVISIONAL BOARD TO CONSIDER

As noted by last year's Chair, the Materials FHS practice of double-blind marking every paper by an examiner is beyond the standard practice for other Departments and indeed other Universities. It is not clear that this exhaustive process has significant merit versus the less time-intensive alternatives which would include (a) having one Examiner mark a given paper, while the other marker is the setter of the question (obviously, using two Examiners when one of them is indeed the setter), or (b) using one Examiner to mark, for example the Examiner most expert in the topic, while a second Examiner performs a "check and audit" role to avoid mistakes. With the increasing size of the student body and the increasing pressures on staff time, it may become urgent to visit the question of whether such changes should be made.

The Materials FHS Part I does not use vivas in normal circumstances, and no vivas where used in 2020.

Broadly, it is the opinion of the Chair that the radical changes forced on our procedures in 2020 have revealed that the system can benefit from permanent alterations:

1. The **open book model certainly has merits** and might be considered for permanent adoption. It prevents too much "rote learning" and questions that simply require students to regurgitate knowledge. This is probably a good thing in general, and the need to adapt papers for open book (plus the marking experience, as noted in the specific paper Reports later in this document) revealed that, arguably, FHS Part I had evolved to contain rather too much of this type of material. However, it must be recognised that a certain internalisation of knowledge and know-how is vital for a person to be worthy of an Oxford Materials degree. The question of whether such knowledge can be examined in form that is, so to speak, "google-proof" is a challenging one. Formats where a student must use their knowledge in a novel scenario ("Suppose that you are asked to design a fabrication process for…") proved to be one useful solution.

   If indeed questions can be designed that meet this need, then possibly **the open book format could become the standard format for FHS Part I exams**. Ideally such exams would still be invigilated, whether centrally in exam schools or locally in e.g. Colleges, so that students can be comfortable that none of their peers are cheating (a concern that was expressed on several occasions by the students).

2. **Digital submission of scripts** proved to be effective and indeed convenient for markers. There had been concerns that photos of scripts might be challenging to read, but generally this was not the case and poorly legibility was more likely to result from more handwriting as in any prior year.

Meanwhile the digital format had several benefits to examiners:

a. Both Examiners could mark a given set of scripts simultaneously, without the challenge of scheduling hand-over of scripts from one person to another and the attendant risk of a script going missing or being damaged.
b. Examiners could annotate comments and marks directly on the digital versions (since each Examiners had their own copy on their local machine). This proved helpful in e.g. the reconciliation meetings when two Examiners needed to understand why their marks differed.
c. Examiners and moreover the non-Examiner markers that were used for the OP papers (i.e. the original setters of the questions) were not constrained to be in Oxford but could have fulfilled their duties equivalently for anywhere in the world. In practice the Examiners were present in Oxford but this potential for mobility is a significant benefit.

In view of these significant benefits, it is the Chair's opinion that the Department should **consider moving to digital script marking as a permanent step**. In the event that exams move back to the traditional Exam School model, then scripts could be scanned by a small team (two to four) of paid staff, such as trusted postdocs, in the day following each paper's completion. Indeed this kind of model had been scheduled to be trialled in 2020 for the OP papers, before the pandemic forced a move to the comprehensively digital solution.

D. EXAMINATION CONVENTIONS

In addition to normal practice, separate Conventions were issued to the students to cover the adjustments for COVID-19, sent electronically along with other information in a letter from the Chair of Examiners to all candidates. The Examination Conventions were agreed by the Board of Examiners and the Department's Academic Committee.

Part II

A. GENERAL COMMENTS ON THE EXAMINATION

There were 30 candidates for the examination, all of whom were awarded Honours. The examination consisted of six written papers plus coursework that included a team design project, a business plan, industrial visit reports and practical work carried out during the 2nd year. Two candidates opted to take a supplementary subject; one candidate opted to take the Foreign Language Option. These replaced the business plan. In addition, candidates completed further coursework in the 3rd year in the form of either a module on Materials Characterisation (eight candidates) or one on Materials Modelling (twenty-two candidates).

Each written paper lasted three hours. For the General Papers, candidates were required to answer five questions out of eight, as in previous years. For the Options Papers, candidates were offered ten questions in five sections each containing two questions; candidates were required to answer four questions, one from each of three sections and one from any of the same three sections.

Team design projects were marked by two Examiners. Teams were marked as groups. The allocation of bonus or penalty marks is permitted under the Conventions, and indeed one candidate was marked down by 1 mark.

The Business Plans, submitted in the second year, were marked by an Assessor from the Knowledge Exchange and Impact Team of Research Services and an Assessor appointed to represent the Faculty of Materials, again with teams being marked as a group.

Candidates' work on the two coursework modules was marked by two Assessors. One of the examiners further examined a number of representative scripts from both modules, but felt that no further moderation of marks was necessary.

Reports for each of the industrial visits were assessed by the Industrial Visits Organiser, appointed as an Assessor.

The overall mean mark for Part I was at the First/Upper second boundary at 77.88%. The average marks for all papers except GP2 were in the low to mid-range of the 1st class band; GP2 was in the mid 2(i) band. (GP1 70.23, GP2 65.07, GP3 73.57, GP4 72.63, OP1 76.03, OP2 69.43). No scaling was applied, and indeed the examiners would not have been minded to apply a scaling even if the same marks had been achieved in a 'normal' year; that said, **the marks trend high and this should be noted by the Examiners for the 2021 Part I.**

B. EQUAL OPPORTUNITIES ISSUES AND BREAKDOWN OF THE RESULTS BY GENDER

The performance of the male and female candidates was as follows:
Written Papers Averages – M 70.90%, F 71.56% (Overall 71.16%)
Coursework Averages – M 67.98%, F 73.14% (Overall 70.04%)
Overall Part I Averages – M 70.17%, F 71.95% (Overall 70.88%)

Insofar as can be judged from the small sample size, the performance of male and female candidates was not significantly different. This statement is based on the standard deviation of the written paper averages, which was ±10.15% points for the male candidates and ±7.06% points for the female candidates. Females performed better in the coursework than written papers but males performed better in the written papers – this is atypical, and may be an effect of the small statistical sample. **However is it something that Examiners for 2021 may wish to monitor.**

Students with SpLDs were given time extensions in the open book, remote exam format in much the same fashion that they would have in a normal year. However the largest allowance possible, which applied to one student, was an extension from the standard 3+1 hours to 24 hours. This was felt by the examiners to be concerning given the problem-solving nature of many questions, where a degree of time pressure (appropriately corrected for SpLD) is essential. **The Chair and Examiners for 2021 may which to liaise with the University to establish whether such extreme time extensions are to be used.**

	Overall mark		Written Examinations		Coursework	
mark (%)	Male	Female	Male	Female	Male	Female
30-40	-	-	-	-	-	-
40–50	-	-	-	-	-	-
50–60	2	-	3	-	2	-
60–70	6	5	4	5	11	4
70–80	9	6	8	6	5	8
80–90	1	1	2	1	-	-
90-100		-	1	-	-	-
Totals	18	12	18	12	18	12

C. DETAILED NUMBERS ON CANDIDATES' PERFORMANCE IN EACH PART OF THE EXAMINATION

All candidates took the same papers for the whole examination, in that there were no optional written papers.

D. COMMENTS ON PAPERS AND INDIVIDUAL QUESTIONS

Detailed comments on the written examination papers and overall candidates' performance on individual questions are attached.

E. COMMENTS ON THE PERFORMANCE OF IDENTIFIABLE INDIVIDUALS AND OTHER MATERIALS WHICH WOULD USUALLY BE TREATED AS RESERVED BUSINESS

For coursework, eight applications for consideration of Mitigating Circumstances: Notices to Examiners were received for the interim board in TT20, and medical certificates for a further two candidates relating to missed assessments were also considered by the examiners. [redacted]

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For the written examinations, fourteen applications for consideration of Mitigating Circumstances: Notices to Examiners were received. [redacted]

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F. NAMES OF MEMBERS OF THE BOARD OF EXAMINERS

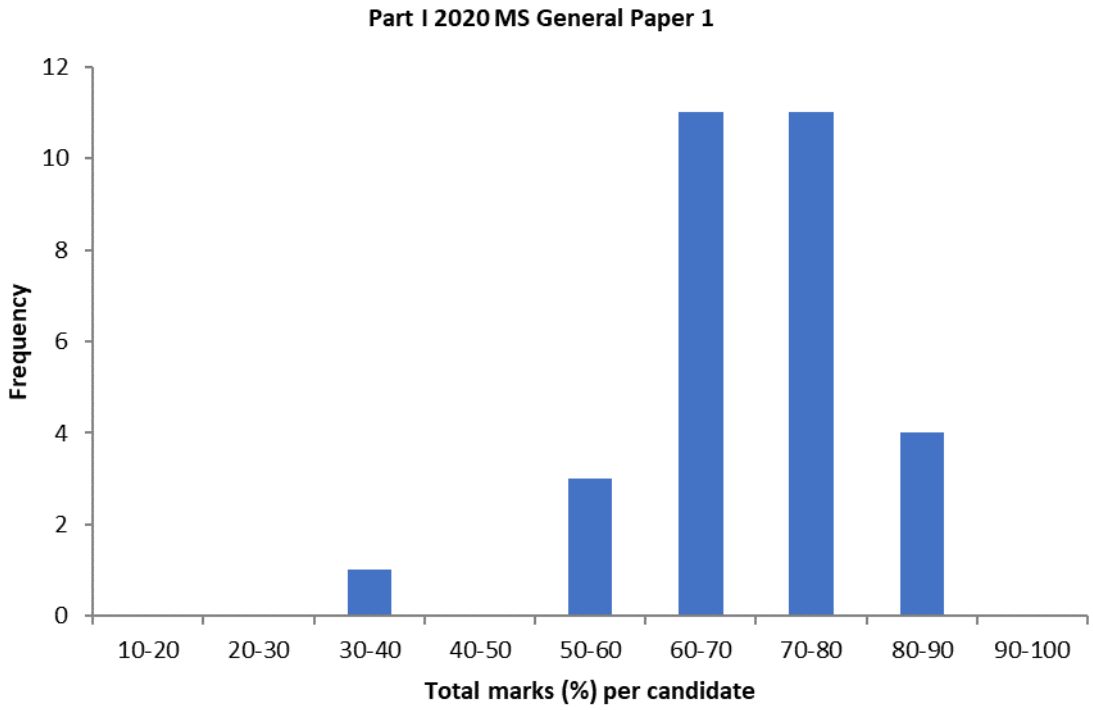
Prof. H.E. Assender	Prof. S.C. Benjamin (Chair)
Prof. T.J. Marrow	Prof. P.D. Nellist
Prof. R.I. Todd	Prof. R.C. Reed
Prof. A.J. Davenport (external)	Prof. P.D. Haynes (external)

General Paper 1 – Structure and Transformations

Examiner: **Professor Roger Reed**
Candidates: **30**
Mean mark: **70.23%**
Maximum mark: **84%**
Minimum mark: **37%**

Detailed comments on the paper are as follows:

Question	No of Answers	Average Mark	Highest Mark	Lowest Mark	Topic
1	17	14.09	18.5	10	Microstructure of Polymers
2	11	12.91	17	4	Phase Transformations
3	20	12.65	17	7	Phase Transformations
4	26	15.65	19.5	9	Surfaces & Interfaces
5	22	14.23	18	8	Diffusion
6	12	16.33	19	11.5	Ternary Phase Diagrams
7	24	12.83	18	9	Corrosion and Protection
8	18	13.42	18	6	Powder Processing



General Comments

The GP1 examination paper was constructed with the open book conditions specifically in mind. Accordingly, the questions were tailored to test understanding of the underlying concepts. The examiners (both internal and external) believe that the paper was fair – there were no significant disparities between the average marks awarded for the different questions. The quantitative evidence supports the conclusion that this GP1 paper was successful in helping to distinguish between the more and less capable students.

Questions

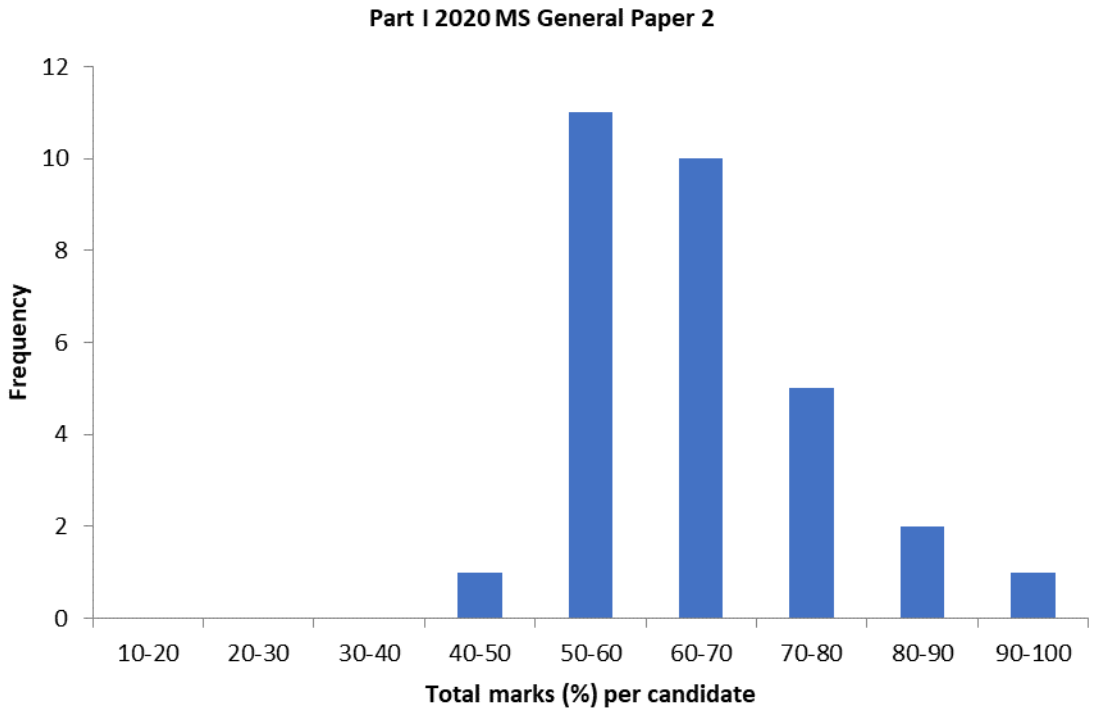
1) About half of the students attempted this question. The average score was 14.1 with high/low of 18.5/10. Considered to be a good question which tested concepts.
2) Not popular – only 1/3 or so of students attempted this question. The average score was 12.9 with high/low of 17/4. The majority of students were able to identify the correct micrographs but were not always successful with the follow up parts.
3) Two thirds of the students attempted this question. The average mark for this question was the lowest for this paper, at 12.6. Some students chose to regurgitate/copy out notes, rather than concentrating upon answering the questions posed.
4) Very popular question attempted by nearly all the students. Average score of 15.6 with high of 19.5 and low of 9. The quantitative part was particularly helpful for identifying the more and less knowledgeable students.
5) The question tested five distinct areas of diffusion theory. It was attempted by approximately 2/3 of students and led to a reasonable distribution of marks.
6) This was not a popular question, with only 1/3 students attempting it. But students who attempted it scored well at an average of 16, suggesting that if the material was known a good score followed.
7) A popular question but one which really tested the students, leading to the second lowest average mark on the paper. On the whole, the last part was answered well with the majority of the students recognising the phenomenon of stress corrosion cracking. The first section a) was less well answered with some students unable to explain the concept of passivation adequately.
8) Average score of 13.6 and high/low of 18/6. The question was tailored specifically to test the students' appreciation of the importance of manufacturing on the quality of parts designed by additive manufacturing. Well answered on the whole, but the weaker students did not appreciate the thrust of the last two parts.

General Paper 2 – Electronic Properties of Materials

Examiner: **Professor Simon Benjamin**
Candidates: **30**
Mean mark: **65.07%**
Maximum mark: **93%**
Minimum mark: **45%**

Detailed comments on the paper are as follows:

Question	No of Answers	Average Mark	Highest Mark	Lowest Mark	Topic
1	7	12.21	14	9	Electronic Structure of Materials
2	14	9.71	19.5	4.5	Electronic Structure of Materials
3	29	12.74	19.5	5	Quantum & Statistical Mechanics
4	26	10.75	19.5	5	Quantum & Statistical Mechanics
5	29	14.36	20	9.5	Magnetic Properties of Materials
6	9	11.17	16	7	Tensor Properties of Materials
7	14	13.82	18	10	Electrical & Optical Properties
8	22	16.18	19	13	Semiconductor Materials



General Comments

Overall the paper was competently handled by the majority of candidates. A conscious decision (pre-Covid crisis) was taken by the examiners to increase the diversity and challenge of the questions versus prior years because of a perceived risk that otherwise questions would become merely variations on established formulas. Consequently it was expected that the mean mark might fall slightly and indeed this occurred; the mean mark of 65% was well within the expected range.

The need to adjust the questions for the open book model had relatively little effect on GP2 as the work is in any case problem-orientated with all questions requiring unique calculations that make the exam inherently well balanced with respect to online search and note checking.

The following is a general remark regarding student best-practice in handling the problem part of GP2 questions, and indeed questions on other papers where a derivation part is followed by a calculation:

1. It is important to manipulate equations using symbols until “the last line” at which point it is relevant to insert actual numbers into the expressions. Several students exhibited the habit of replacing symbols with numbers early in an analysis, so that a mix of numbers and symbols appeared in derivations (e.g. (3.244)X+(5.304)^2 P X = ….). The consequence of this bad practice was that it was sometimes impossible for examiners to tack the source of an error that led to an incorrect final answer, meaning that students lost marks that might have been awarded for an almost-correct derivation.

2. Students sometimes presented answers that were dimensionally incorrect (as when an energy is requested in the question but energy/distance is reported as the answer). This is a missed opportunity to notice an error and, even if time does not permit an error to be located, noting “This answer is dimensionally incorrect” demonstrates to the examiner that the student is aware of this basic problem with their solution.

Questions

1) This question concerned the tight binding model. It was the least-popular question with only 7 attempts; the average mark achieved was mid-range for the paper.
   The question began with “bookwork” style sections requiring the candidate to explain aspects of the tight binding model and to perform calculations similar to those in lectures. Candidates generally demonstrated an understanding of the principles although there were generally flaws (inadequate treatment of sums over multiple integrals) that lost marks.
   The final part of the question, worth six marks, concerned a density-of-states figure which the candidates were required to explore by calculating key points and justifying characteristics. This was challenging as it required mixing an understanding of tight binding and of density of states derivations; the segment was not well done, with several students making no attempt and no student achieving more than half of the 6 marks available.

2) This question concerns a one-dimensional atomic chain. There were 14 attempts. In the first segments of the question candidates were required to apply Bloch’s theorem and calculate features of the Brillouin zone and this was generally well performed. Parts (c) and (d) concerned the Fermi vector and energy, which was to be found first for the case of free electrons and then with the potential in mind; generally candidates demonstrated an understanding of these concepts and how they can be treated. Part (e) presented candidates with an approximate solution and required them to verify its validity and estimate the energy ordering; the later task was well performed by a number of candidates while several others scored zero marks, indicating that only some students had grasped the underlying point. The final part of the question asked candidates to consider a distortion to the chain and describe the implications; the candidate’s responses were wide ranging with only a few identifying the fully correct effect.

3) This question was a wide ranging exploration of basic quantum mechanics, requiring students to explain the key concepts [12 marks] and then to perform an analysis of a 1D problem [8 marks]. The question was jointly the most popular with 29 attempts (i.e. almost all of the candidates) and the mean mark was mid-range for the paper.
Generally the candidates did reasonably well on the earlier parts of the question which required explanations of key QM concepts. For a couple of students, the instruction "by analogy with vectors, or otherwise…" led to them answering the parts they were less comfortable about *purely* by talking about vectors without reference to QM, thus gaining no marks.
The latter half of the question required students to recall that any pure quantum state can be written in terms of the eigenstate of a given operator, and to do this for a specific case. Some students became confused about the proper way to write the given state as a superposition, or the use of the term "kinetic energy" in the final part (not noticing that the potential energy is zero for valid states in the infinite potential well).

4) This question involves Boltzman distribution, partition functions and harmonic oscilators, leading into a practical part where candidates are asked to explain the origin of features in a table of heat capacities for certain materials. The question was the third most popular with 26 attempts; the average mark was the second-lowest on the paper.
Generally the first half of the question, requiring candidates to recall the definitions of key concepts and to use them in standard derivations, was well-attempted by the majority of students. In particular part (b) concerning the derivation of the 1/sinh() form of Z, was performed almost perfectly across the cohort, indicating that this element of the course was well-revised and perhaps anticipated by candidates.
The second half of the question, concerning the explanation for the heat capacities for specific materials, was less consistently well done. Some students failed to link the explanation to the ideas that they had been reminded of in the former part of the question and instead reaching for possible remarks from their general recollection of materials properties (which were not always correct and not always relevant).

5) This question, concerning. Hund's rules and magnetism, was the joint most popular question with 29 attempts, i.e. nearly the entire cohort. The mean mark for the questions was also the second highest for the paper. The first segment of the question, concerning the use of Hund's rules and the calculation of the g factor and total magnetic moment for certain ions, was well done by the candidates indicating that it had been well revised and perhaps anticipated. The next part concerning a calculation of diamagnetic susceptibility was fairly well done with the majority of candidates understanding the steps they were being asked to perform. The final part concerning gallium's properties versus its position in the periodic table was "hit and miss" with several candidate providing a good answer while others made no attempt or were unable to provide meaningful answers.

6) This question concerned Mohr's circle and its use in analysing stresses near the surface of a tyre as a vehicle accelerates. The question was the second least-popular with 9 attempts; its mean mark was toward the lower end for the range in the paper.
The first segment involving an explanation of Mohr's circle was well performed, but this is the standard start to a question on the topic and would have been well-revised by students who anticipated they might wish to attempt such a question.
The main part of the question, i.e. the calculation of the stresses in a tyre, had a substantial block of marks (12, i.e. 60% of the question) assigned to a problem where the students were not 'led by the hand' but instead had to apply their understanding to perform a complete analysis. The problem itself was relatively straightforward, but the majority of students 'took a wrong turn' at some point, whether in the setting-up of the problem (direction of forces etc) or in the use of Mohr's circle in the context. However there were some good answers achieving near full marks.
The final part of the question regarding the materials properties for skid resistance was generally answered by candidates reaching for their general materials knowledge, with mixed results.

7) This question concerned electromagnetic waves and the effects that can occur when they are incident on a transparent medium. The question was mid-range in terms of number of attempts and mean mark achieved.
The first three parts of the question (a)-(c), concerning the physics of EM waves, was well performed by most of the candidates, with some marks lost for 'careless slips' such as confusion over epsilon zero versus mu zero, or between 1/(speed) and (speed).
The sections on zero reflection and Brewster's angle were attempted by most candidates, with the weakest point being the physical explanation for the effect (asked for in part (d)).
The last part of the question regarding a stack of glass sheets was quite well handled by majority of candidates who attempted it, indicating perhaps that it had come up in revision for a number of the students.

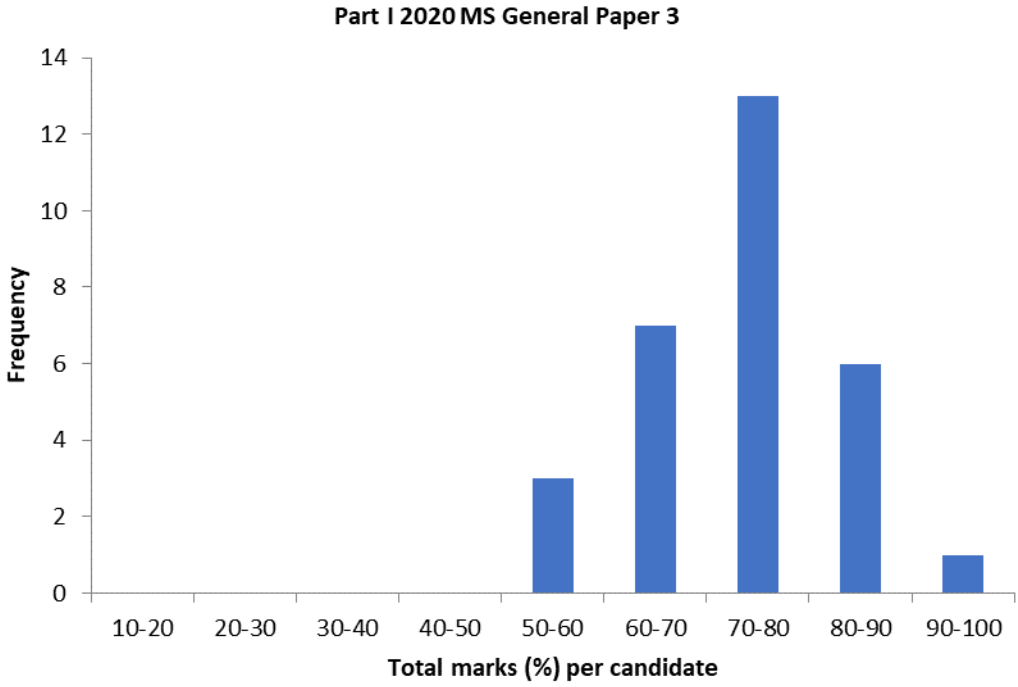
8) This question involving doped semiconductors was quite popular with 22 attempts, and moreover it had the highest mean mark of all questions on the paper.
The first part (a) concerning the effects of doping over a range of temperatures was well-answered by almost all students; the required response is of course basic for the topic and can also be searched efficiency.
The largest segment of the question, concerning a derivation of an expression for the number of electrons in the conduction band, was also well-answered with almost all candidates understanding the essentials of the derivation and marks lost mainly for failure to explain assumptions clearly. Similarly the following 4-mark part about the position of the Fermi energy was quite well tacked.
The last part of the question involved putting numbers into the expressions in order to derive a ratio, was generally well answered although a couple of candidates obtained a grossly incorrect answer without noting on their script that the answer was unreasonable.

General Paper 3 – Mechanical Properties

Examiner: **Professor James Marrow**
Candidates: **30**
Mean mark: **73.57%**
Maximum mark: **94%**
Minimum mark: **55%**

Detailed comments on the paper are as follows:

Question	No of Answers	Average Mark	Highest Mark	Lowest Mark	Topic
1	27	15.43	19	11	Mechanical Properties of Composites
2	23	15.20	18	9.5	Mechanical Properties of Polymers
3	6	10.67	14.5	4.5	Fracture & Fatigue
4	27	15.91	20	8.5	Macroplasticity & Mechanical Working Processes
5	16	12.63	19	3	Microplasticity
6	22	16.59	20	10.5	Elastic Behaviour in Isotropic Solids
7	13	13.54	19.5	5.5	Creep
8	16	12.25	17	9	Microplasticity



General Comments

The questions in the paper as open book were of similar style to those that would be presented in a conventional closed book paper. There were opportunities to gain high marks on some questions, particularly numerical/derivation with complete solutions that demonstrated full understanding of the material, such as questions 1, 4 and 6. Questions that required consideration of essentially unseen material (e.g. Question 3) were less popular, which indicates they were perceived to be more challenging. The overall spread of marks indicates that the majority of questions contained sufficiently challenging elements, though a greater weight could have been given to parts of questions that required more insight.

Questions:

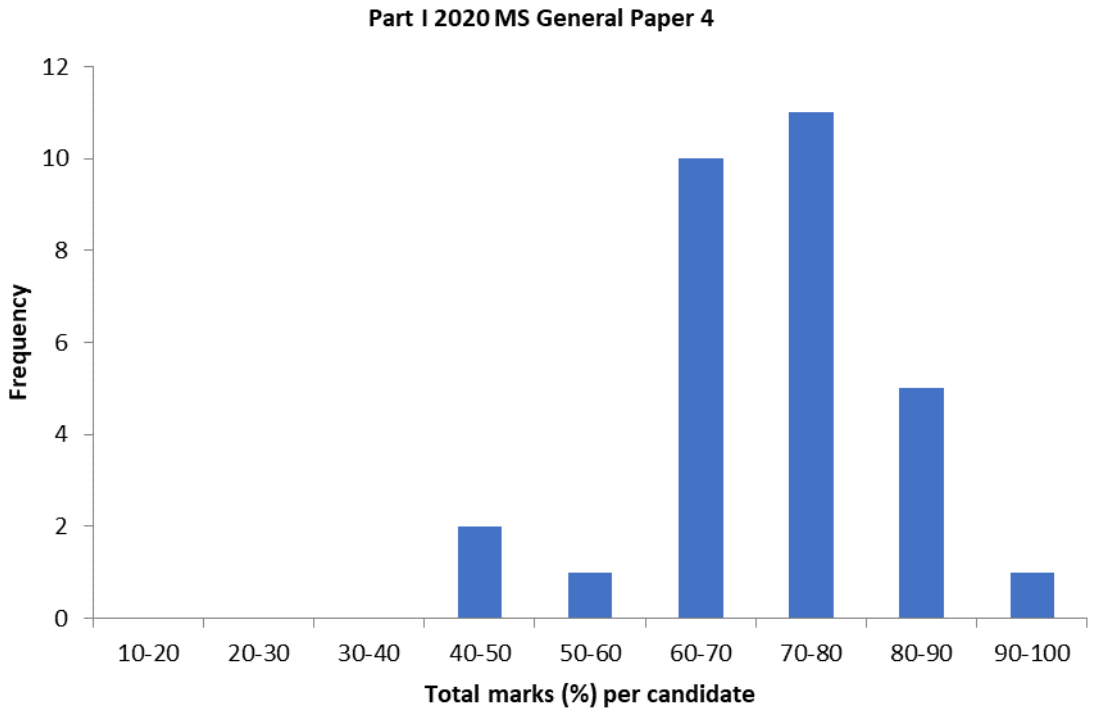
1) a) most answered well, but there was confusion over the difference between long discontinuous fibres and short discontinuous fibres in some answers, b) i) well done by most, with some errors in the Poisson parameters ii) mostly well done, but some errors in the correct shape of the curve and the values at 0° and 90° were not always specified iii) some errors in the correct calculation of the normal and shear stresses needed to evaluate the strains, c) many did not take into account the given properties of matrix and fibres in the discussion of the possible application of this composite.
2) a) generally answered well, though some did not explicitly consider the link between properties and processing b) most gave clear answers though some proposed methods of Tg measurement that were quite sensitive to strain rate, c) quite a few did not discuss in terms of entropy and the quiescent state of the molecule, nor the mechanism of conformational change, d) generally clear, though a significant number did not consider the effect of frequency on the relative magnitude of the loss tangent peak, e) clear answered, though some did not explicitly state how cross link density and Tg were related.
3) a) i) most did not appreciate that fracture in steels requires propagation of defect with size that scales with grain size, and discussed fracture in terms of initiation only, ii) mostly well done though not all clearly discussed role of solid solution strengthening using their derived equations, b) i) answers tended to lack full detail, iii) some did not consider the fatigue process, iii) those who attempted this simple calculation obtained correct magnitude of critical shear stress, but none extended this to estimate the required tensile strength of a polycrystal.
4) a) generally well explained, b) most did not state the assumption of conservation of volume and some gave unclear descriptions of Considere's criterion, c) well done, most did not correctly express UTS as an engineering stress, d) some quite inaccurate methods and many did not consider how to achieve high strength as well as high strain before necking
5) a) most were correct, but some incorrectly presented Burgers vector as changing along the dislocation line, b) some did not solve for an arbitrary point but gave a special case, c) mostly well done, d) various unit errors and incorrect solution for the strain, e) some treatments were oversimplistic or did not consider the role of source operation for continued deformation.
6) a) generally clear explanations provided, b) some did not define the directions of the principal stresses, c) some did not clearly explain the interaction with the proposed defect
7) a) most gave a sufficient summary of the salient points, b) quite a few did not explain the key step in the analysis from the starting point that strain was constant, and some over complicated the analysis to obtain the creep exponent that could be related to the mechanism
8) a) mostly well done though not all examples were clear, b) quite a few did not discuss why grain size affects the number of dislocations in the pile up (back stress), c) generally well done, though some approximations were inaccurate, d) most discussed precipitation, but this alloy is below the solubility limit (as made clear in the earlier part of the question) so no precipitation occurs. Needed to consider quenched in vacancies.

General Paper 4 – Engineering Applications of Materials

Examiner: **Professor Pete Nellist**
Candidates: **30**
Mean mark: **72.63%**
Maximum mark: **91%**
Minimum mark: **46%**

Detailed comments on the paper are as follows:

Question	No of Answers	Average Mark	Highest Mark	Lowest Mark	Topic
1	23	15.11	19.5	5.5	Microstructural characterisation
2	25	14.02	16.5	11	Microstructural characterisation
3	4	11.75	14.5	10	Engineering applications of polymers
4	29	15.05	19	8	Ceramics and glasses
5	12	12.63	18.5	6	Ceramics and glasses
6	13	13.92	17.5	6	Engineering alloys
7	18	15.69	19	8	Engineering alloys
8	26	14.17	18	8	Semiconductor devices



General Comments

Historically, this paper has had a relatively large component of book-work. From the originally written, closed-book version, it was adapted to open-book through ensuring that descriptive parts required some element of distillation, or by replacing book-work sections with problems that required original thought. The mean mark was relatively high, perhaps reflecting the benefit of open-book for this paper, but the examiners felt that the paper as a whole had been well-answered and the marks reflected candidate ability. For the descriptive sections it was possible to identify examples where candidates had reproduced notes but had not shown the critical thought to adapt them to the specific requirements of the question. The variation of mean marks between questions was felt to be within acceptable limits, despite wide variations in question popularity.

Questions:

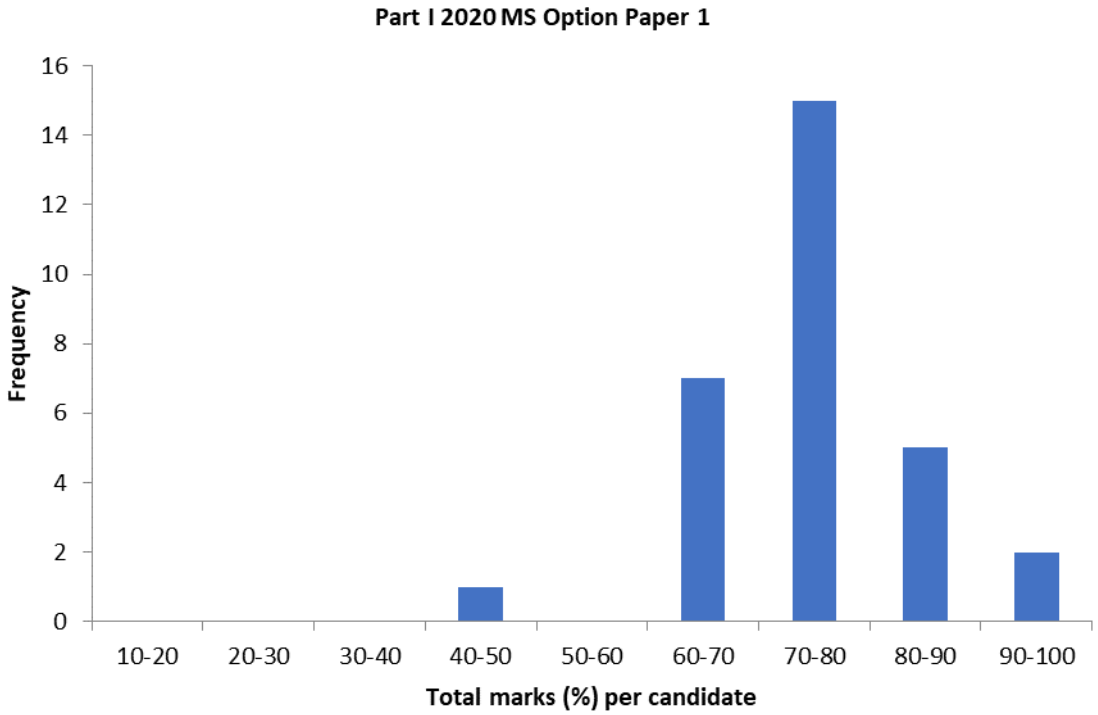
1) Apart from the initial 5 mark descriptive section, the question was an unseen problem. It produced a wide range of marks, but many candidates answered accurately showing good understanding. A significant fraction could not remember how to calculate the required dissociation reaction for the last part (taught in Year 1).
2) Part (a) [worth 8 marks] required a distillation of notes and/or other reading. There was a wide range in quality of explanations. Some students were not able to explain the origin of the interaction volume and why different signals originate from different parts of the interaction volume. The remainder of the question was unseen problem solving and was generally well done. Many students spotted the link in part (c) to scanning transmission electron microscopy.
3) An unpopular question, perhaps because the parts on flow rates were unfamiliar. Nonetheless, the marks ranged across a relatively tight spread between 11 and 14. Most candidates correctly identified melt extrusion as the method of choice, and were able to explain its principles well. Parts (b) and (c) are unseen, and were found to be more challenging to navigate by most candidates. Part (d) brought in other aspects of polymer properties, with answers that were often lacking in breadth of ideas.
4) Part (a) [4 marks] was book-work that required little distillation and scored high marks. The remainder of the question was an unseen Weibull modulus problem. In general this was well done, but many candidates over-complicated the problem by attempting to use a ranking of failure stresses, or using the mid-range stress, both of which were not appropriate to the problem as presented here. The comparison between HIP and pressure-less sintering in part (d) was generally answered well.
5) Parts (a) and (b) [6 marks combined] were largely book-work with little distillation of ideas needed, and scored highly. Part (c) was an unseen problem. Although not particularly complex, several candidates managed to get confused around ideas such as whether the glass coating was in tension or compression and how that might impact on its performance as a coating.
6) Parts (a) and (b) [10 marks combined] were largely book-work, but did require some distillation of notes to provide a summary focusing on the required elements. These parts were answered well. Part (c) was an unseen problem and somewhat unfamiliar in form, but generally well attempted with candidates able to see how to approach the problem.
7) Parts (a) and (b) [6 marks combined] were book-work and well-answered. The remainder of the problem was an unseen figure-of-merit problem. Many students were able to see how to approach the problem and were successful in solving it. In part (f), some students restricted themselves to just one failure mode and could have thought more broadly about answering this question.
8) Parts (a) and (b) [10 marks combined] required a distillation of the notes. There were many clear explanations, though some students managed to confuse the directions of the drift and diffusion currents, and the directions of flow of the electrons and holes. Part (c) required some original thought, and few scored full marks on this section and candidates could have thought more broadly about the materials factors involved.

Materials Options Paper 1

Examiner: **Professor Richard Todd**
Candidates: **30**
Mean mark: **76.03%**
Maximum mark: **95%**
Minimum mark: **47%**

Detailed comments on the paper are as follows:

Question	No of Answers	Average Mark	Highest Mark	Lowest Mark	Topic
1	13	16.65	20.5	10.5	Advanced Manufacturing
2	7	18.57	24	11.5	Advanced Manufacturing
3	2	21.25	23	19.5	Nanomaterials
4	1	20.00	20	20	Nanomaterials
5	24	21.15	24	16	Optics and Optoelectronics
6	4	19.00	21	17	Optics and Optoelectronics
7	18	17.14	23	7	Prediction of Materials Properties
8	11	18.77	24	9	Prediction of Materials Properties
9	20	18.98	23.5	15	Engineering Ceramics
10	20	19.30	24.5	12	Engineering Ceramics



General Comments

Questions:

1) (Advanced Manufacturing with Metals and Alloys). A question requiring a detailed understanding of solidification. A majority of candidates showed familiarity with the main points in part (a) but most answers lacked detail. Most answers to part (iv) showed understanding of the two processes involved but did not always give a genuine comparison of them. In parts (b) and (c), most candidates displayed a good understanding of the modification of Al-Si alloys and of the reasons for degassing melts prior to casting.

2) (Advanced Manufacturing with Metals and Alloys). A question requiring the application of understanding of a range of fabrication methods to an unseen problem and therefore well suited to this open-book examination. Attempted by 7 candidates, 3 of whom scored close to full marks. The majority of answers to part (a) gave an appropriate choice of welding method accompanied by a good justification and description of the process. A few candidates opted for the less appropriate option and were unable to justify its use for aluminium by mentioning the possibility of fluxes to overcome the problem of oxide formation. In parts (b) and (c), most answers concerning resistance to corrosion and wear were substantially correct. Part (d) gave the candidates the most freedom to speculate and the answers covered the full range of possible marks.

3) (Nanomaterials) Only two students attempted this question, which had two parts. The content in (a) and (b) leads the the candidate to describe the impacts of the choices of etching process and materials choices (high-k dielectric) that allowed the scaling of transistors to progress through so many orders of magnitude. Then part (c) invites the candidate to think through a novel technology based on nanotubes, in such a way that their understanding of process flow is tested, together with their intuitive grasp of what makes up a transistor.

   The first sections (a)+(b) of the question were well-tackled by both candidates. This is core book work with some interpretation so it was to be expected that a well-prepared student would do well. As a guide for future years, it would have been more ideal to push the candidates' understanding a little further beyond simply giving a standard account of the relevant processes. The second theme of the question in part (c) was well-attempted by one of the candidates but other's answer revealed some confusion about how a nanotube might form the core of a transistor, and hence how suitable structures could be created. This part provided good differentiation because it is not a "google-able" component.

4) Only one candidate attempted this question on defects in carbon nanomaterials. The question had three distinct parts. Part (a) concerned the formation mechanisms for graphene and their respective merits. This corresponded to the course and was well answered. Part (b) defects and the role they play in dictating curvature. The question was fairly straightforward and again correlated directly to notes from the course. The third part required the candidate to identify the source of two Raman spectra by recognising key features. While the candidate's script provided only an imperfect answer to this task, the key ideas were described. Overall the question was relatively well answered.

5) (Materials and Devices for Optics and Optoelectronics). The most popular question, done well by most candidates. The understanding of the propagation of light in discrete modes and the origins of inter- and intra-modal dispersion was good for many candidates in parts (a) and (b). There was a high proportion of correct answers to the related calculations. Part (c), on attenuation, scored very highly, mainly because much of the information needed to do it could be accessed easily in this open book examination. Very few students were aware of the increase in Rayleigh scattering in photonic crystal fibres in part (d). Many students got full marks for the attenuation calculation in part (e). The most common problem for those who did not was in the maths associated with the description of attenuation in dB.

6) (Materials and Devices for Optics and Optoelectronics).This question had only 4 attempts. The large essay-type part (a) was worth [12] marks and likely put many students off. This required students to contrast edge-emitting and vertical cavity surface emitting lasers. The material corresponded to themes from the course and was well answered in general by the

students that attempted the question. The second part of the question required candidates to identify materials choices that would be suitable for realising solid state lasers with certain properties. All four students displayed some understanding of the issues, however none of the students achieved perfect or near-perfect marks. The last part concerning extending to long wavelengths was particularly challenging to the students. Overall this second half of the question provided good differentiation and was material that could not easily be “googled for”.

7) (Prediction of Materials Properties). This popular question had 18 attempts. It concerned solving the many-body Schrodinger question using trial functions with very simple forms, and understanding the Hartree and Exchange components (and manipulating them in this simple context). There were novel derivations in parts (b) and (c) and part (d) was designed to test understanding, so that the question overall had a high degree of suitability for open book. It was therefore gratifying to see that it was fairly well answered overall. The question appears very long on the exam paper but students generally tackled it in quite a compact form and overall there was no reason to think that it had taken inordinately long to answer. This question was perhaps a little too granular in its mark assignment; coalescing some of the marks into higher-mark groups would have provided more license for nuanced marking.

8) (Prediction of Materials Properties). This question was fairly popular with 11 attempts. It concerned density functional theory and the way in which physical properties can be deduced from the energies calculated from the model. The question was quite self-contained, in that an alert student could have gained marks by inferring the proper steps even if they have not revised the specific approaches here. Overall the question was fairly well answered with 3 of the 11 candidates achieving marks in the 90%+ bracket; students tackled the magnetostriction theme (with elements beyond the course) in part (d) fairly well. The need to perform novel calculations, and this reference to a more advanced theme, meant that the question was well suited for open book. Possibly the granularity of the marks could have been a bit more coarse in order to provide greater flexibility in assigning marks.

9) (Engineering Ceramics: Synthesis and Properties). Parts (a) and (b) were generally well done with marks being lost mainly for lack of detail and difficulty in demonstrating an understanding of the relationship between counter-ion concentration, double layer thickness and repulsion between powder particles. Similar comments apply to part (c), with most candidates scoring highly but some losing marks in part (iii) by not demonstrating a clear understanding of the rate-controlling process in slip casting. Good attempts were made by most candidates to compare and contrast slip casting and injection moulding in part (d) but a small number of candidates confused injection moulding with pressure slip casting.

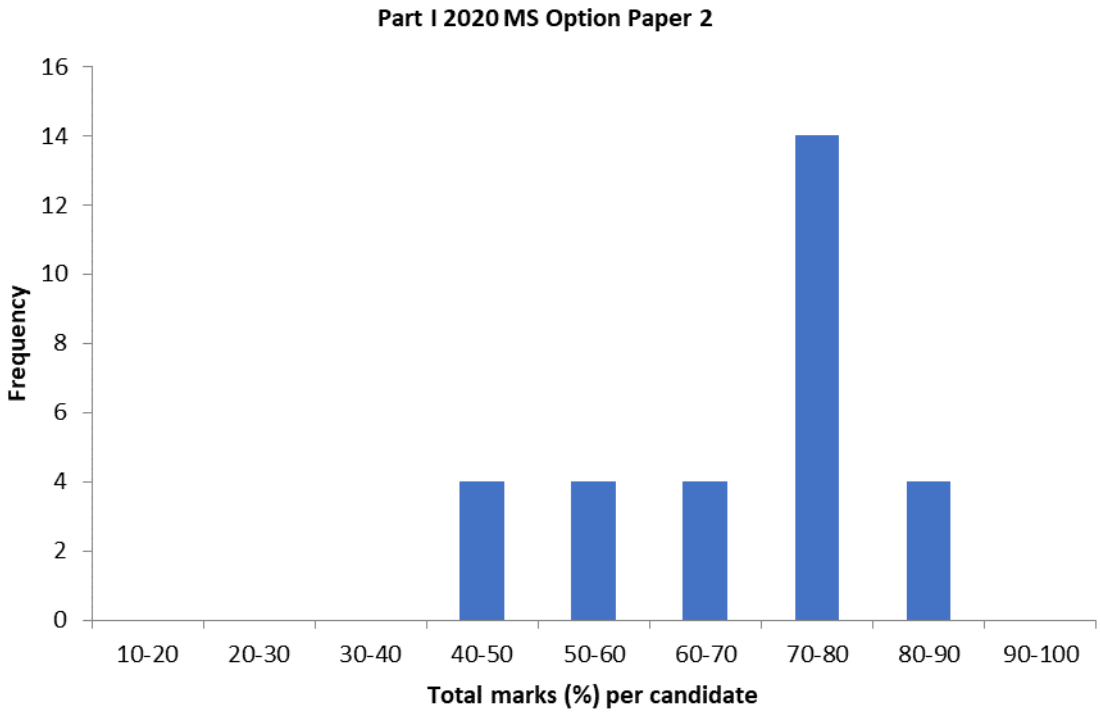
10) (Engineering Ceramics: Synthesis and Properties). Part (a), on the basics of thermal shock, was mostly done well. The unseen calculation in part (b), relating thermal shock to tensile test results was also well done for the most part but quite a few students failed to allow for the biaxial loading mode in thermal shock. The variables involved in the Biot modulus were defined well in part (c). About a third of the answers to this part attracted full marks but other students struggled to explain the effects of the variables on thermal shock, especially that of the heat transfer coefficient. The answers to part (d), concerning the relative merits of SiC and YSZ in high temperature applications, contained few misconceptions but not many students were able to give comprehensive answers to part (i).

Materials Options Paper 2

Examiner: **Professor Hazel Assender**
Candidates: **30**
Mean mark: **69.43%**
Maximum mark: **89%**
Minimum mark: **46%**

Detailed comments on the paper are as follows:

Question	No of Answers	Average Mark	Highest Mark	Lowest Mark	Topic
1	20	20.00	24	13	Devices
2	8	17.56	21.5	13	Devices
3	13	18.58	22	14	Advanced Engineering Alloys and Composites
4	3	16.00	20	12	Advanced Engineering Alloys and Composites
5	5	15.40	20.5	10.5	Biomaterials and natural materials
6	11	14.23	18	9	Biomaterials and natural materials
7	9	12.28	17	8	Advanced Polymers
8	21	18.02	22.5	12.5	Advanced Polymers
9	15	17.77	22.5	10	Materials for energy prod^{n}, distrib^{n} & storage
10	14	18.29	22	8	Materials for energy prod^{n}, distrib^{n} & storage



General Comments

Although this paper attracted a higher average mark than it has over the recent few years, it was not one of the higher scoring papers within this year group. The extent of the spread of marks was similar to previous years, although with a slightly 'sharper' marks distribution, with many candidates scoring in the 70-80% range. This paper has the largest number of modifications made to it to accommodate open book examination, although care was taken not to substantially change the nature of the examination.

Questions:

1) a) most described Lambda sensor well, though some did not discuss the role of cubic stabilisation for thermal shock avoidance, b) generally well answered, with some omissions which systems were unsuitable due to cost, c) i) many did not comment on the piezo and pyro electric properties, ii) generally well answered, though many did not explain the role of PbO loss during processing, iii) most did not consider how the size of Mn3+ would affect its substitution.
2) Part (a) was well answered. In (b) marks were lost by not considering possible alternative materials and reasons for choices. (c) Many candidates lost marks in this section for not clearly considering the relative directions of the field, current and microstructure. Many got the basic idea of pinning and the anisotropy of the microstructure. Some candidates considered current along the c axis. (d) Many candidates were able to identify the effect of pinning, but often the reasoning was weak, and few commented on the features of the microstructure that make this particularly effective.
3) In part (a) candidates often mentioned short and long range order without describing what this meant. (b) was well answered. There was a typographical error in part (c) of the question in the equation for entropy change using Stirling's approximation the first Ln term should be (1+L)/2 not (1+2)/2. No candidate used the wrong expression in their answer. Some candidates were not clear on how enthalpy for a given L related to the enthalpy change required for to calculate the free energy change. Some candidates did not make clear why the L=0 point is that relevant to the critical temperature. The final section on distinguishing the order of the transition was occasionally not answered at all, or only went as far as stating that it is a second order transition and/or describing the trend in L with T, it did not say how this would be used to distinguish which the order is. For (d) candidates tended to list the points from lectures rather than describing the process. Most candidates identified atom probe as a technique to distinguish the nature of the transition in the early stages, but did not always clearly describe what the atom probe would be 'seeing' in each case. In (e) full marks were not gained simply by reproducing the equations for diffusion coefficient without explanation. Some description of the reduction of free energy from local fluctuations in composition was required. Many candidates were vague on which range of composition spinodal decomposition occurred and made non-specific statements such as 'the free energy is lowered on phase separation', or 'it is thermodynamically favoured'.
4) This question was attempted by too few candidates to provide a summary of trends. All parts of questions answered well by at least one candidate, and also poorly by at least one for different reasons.
5) In (a) i) Few candidates referred to the relative lengthscales of the cells compared with the structures. The hierarchical structures were often described, but more specificity of how generated from self-assembly and hydrophobic/hydrophilic interactions was required. Answers to (ii) were often better on the nano and microscale than macroscale. Lengthscales were often not specified. In (b) few candidates identified the inverse relationship between modulus and deposition rate, and in (c) the advantages were not consistently identified.
6) In section (a) the first part was well answered but the second was often poorly answered: Many candidates described why the J curve was advantageous, but did not describe the characteristics of the J curve for each of the two 'applications'. In b(i) some candidates considered changes that may occur during use rather than differences in the material that may give rise to different behaviours. For (c) there were some vague answers e.g. not identifying key features of the curve or not explicitly identifying the cause of mortality,

7) The TPE in section (a) was considered by some candidates as a diblock copolymer additive, rather than a bulk copolymer material. Candidates were surprisingly weak on why polymers tend to phase separate: most did not provide a sufficient account in terms of entropy and enthalpy of mixing, nor the effects of T on properties of the two phases during processing. The answers to (b) often focussed on the interface with the metal, but fewer considered the likely process to apply/set the thermoplastic adhesive: few realised that simple melt processing is used, with physical adhesion only. Few candidates commented on the benefits of an elastomer for an adhesive joint. Part (c) attracted the best marks. Most gave the correct derivation, but there were some errors in the actual application of the test Part (d) was a section (with a small number of marks) that required thinking about the JKR test in the context of the materials system in the question. Some candidates were able to identify the relevance of a less than flat surface to the metal, but did not consider that the TPE material will be melt processed and hence fill the crevices well.

8) In part a) there was a tendency to just give a 'dictionary definition' of Rg, without explanation e.g. of the random coil. In part (ii) the question gave the distance projected along the molecular axis, so it was not necessary to use a bond angle, and some candidates confused monomer length with Kuhn length in the calculation. Part (iii) was the most challenging section that required good understanding of the system. In particular for the second point the importance of fibres (aligned molecules) was often neglected, and on the third point answers were often much more relevant to solution membranes.
Part (b) was mostly well answered though there was some confusion between what was elastic and inelastic scattering, and what was a sum of the two contributions. The comparison between the scattering by H and D was often not explicitly made. most did not suggest or explain the optimum transmission. There was a minor typographical error in part (c) (i) of this question, which should read '….disadvantages of bio-plastics…..', rather than '….disadvantages or bio-plastics' but there was no suggestion from the candidates' answers that this caused any confusion. Many confused 'bioplastics' with 'bio-degradable' plastics, despite the clear definition in the question. A significant number of candidates made little or no direct reference to a life cycle assessment. ii) Candidates tended to identify suitable routes but limitations were non-specific or inaccurate

9) Part (a) attracted good marks, although (ii) tended to lack detail on process and objective to extract fissile material. Part (b) (i) was one of the weaker sections. Most answers lacked a clear discussion in terms of relative probabilities of fission and capture in the relevant isotopes ii) generally well answered, although some poor assessment of the neutron spectrum, c) mostly well answered by those who correctly defined load factor. Marks were lost when there was little reference to the critical components or no justification for the typical values of load factor.

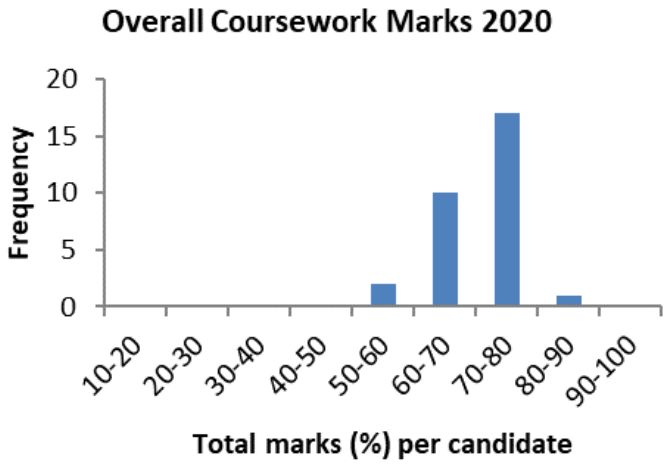
10) a) i) good, though few noted the presence of ash, ii) some descriptions were over-concise to the extent that it was not clear how the two cycles were connected, iii) mostly correct, but few discussed the relative efficiency (lower for parallel flow), b) mostly done well, but with numerical errors, c) i) mostly clearly explained, ii) generally well done but with numerical errors, d) most answers had less detail on materials science aspects than expected

COURSEWORK

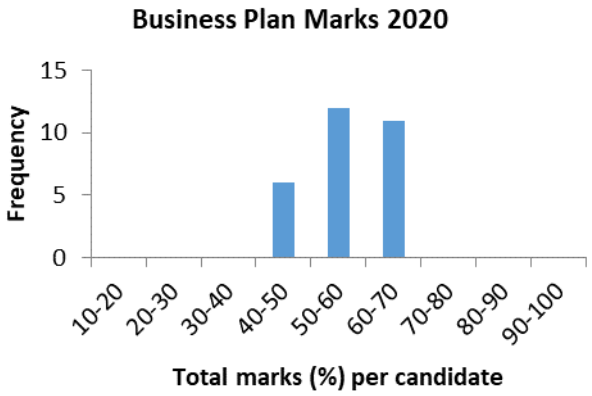
A maximum of 200 marks are available for Part I coursework which comprises:

- Y2 Entrepreneurship & New Ventures: Business Plan – 20 marks
- Y2 Industrial Visit Reports – 20 marks
- Y2 Practical Lab Reports – 60 marks
- Y3 Option Modules: Advanced Characterisation / Introduction to Modelling in Materials – 50 marks
- Y3 Team Design Projects – 50 marks

Overall coursework marks were good, and in the range expected for what is generally continuously assessed work.



The **Business Plan** marks (average 54.57%) were in a relatively narrow range. One candidate was excused from the Bus Plan on grounds of ill health and Part I coursework marks were calculated out of a total of 180.



2019 Report on Business Plans (worth 20 marks)

The candidates for this module were arranged into 5 separate teams, with each team submitting a single business plan. The business plans were marked by two assessors according to the marking scheme published in the course handbook, and were subsequently moderated. Each member of team was awarded the same mark on the basis of the teams work. The assessment criteria are based on 8 different sections of the business plan which are weighted according to their importance for the plan.

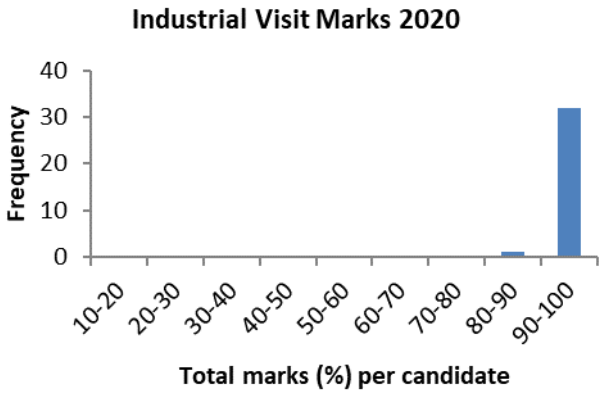
In 2018/19 the different teams performed strongly on different sections of their plans, however that was accompanied by each team having notably weak or average sections of their plan too. This inconsistency across the sections weakened the cases being made, and had an effect on the overall marks given. A strong business plan, which would receive high marks should have strong rationale and arguments in all of the sections which combined make a compelling case (and accordingly high mark).

A significant percentage of the marks (40%) are for the commercialisation issues and risk assessment sections where students can reflect on the challenges faced by their proposals. For most of the teams at least one of these sections were weak, and for some both sections were. Most teams could have spent more time and effort thinking through the issues that may be encountered in commercialising their idea and summarising them clearly. Most teams could have developing their risk assessment sections more thoroughly, both identifying and presenting the major and most impactful risks and developing associated mitigation strategies.

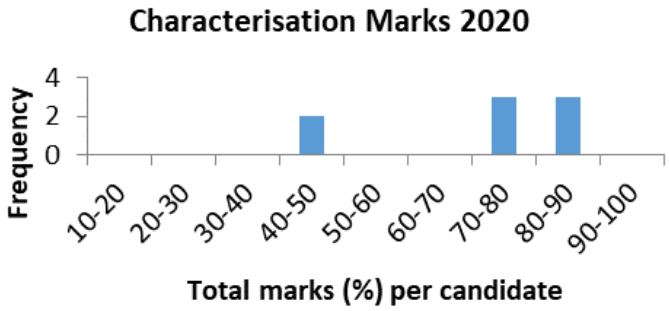
This suggests that the teams did not commit enough time to reflect on the overall business idea, and the weakest sections, and then articulate and present clearly a reflection of the most significant challenges the plans presented.

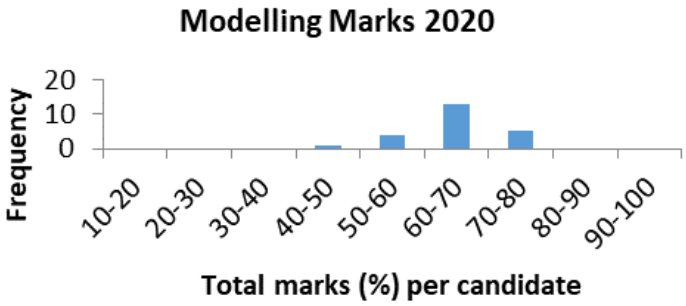
Dr S.M. Wilkinson
Entrepreneurship Convenor 2018/19

The **Industrial Visits** mark (average 99.55%) are near-perfect, as full marks can be obtained by producing a good report; the small number of reports that are only satisfactory or late are strongly penalised.

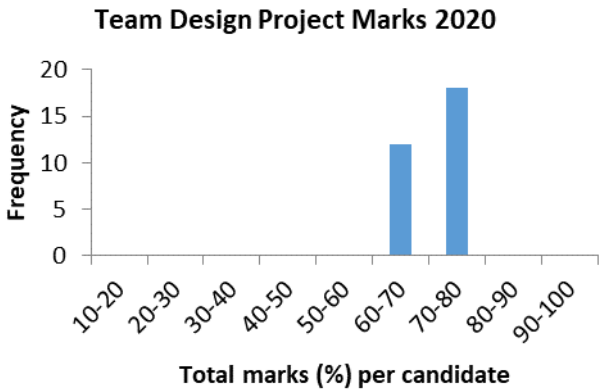


The **Advanced Characterisation** module (average 76.00%) and **Introduction to Modelling in Materials** (average 64.33%) exhibit a full range from 3rd class to good 1st class marks. The work done was reviewed independently by the Examiners.

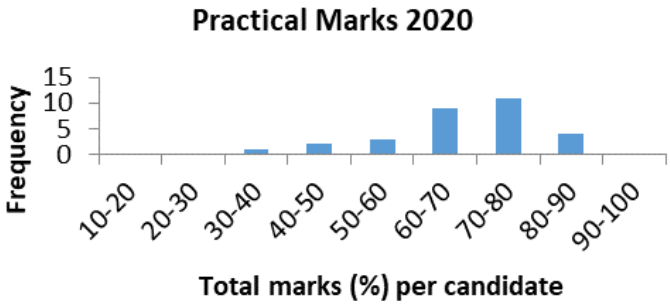




The **Team Design Project** marks (average 69.60%) show a moderate narrow range, close to the upper second/first class level, which is reasonable given the sustained effort in a group task.



The marks for **Practical Classes** (average 67.67%) have been reviewed by the Practical Class Organiser, who concluded that, although the range of marks for an individual practical varied from practical to practical, all students have been treated equally.



Practical No	Average Mark	Highest Mark	Lowest Mark
2P1	6.7	8.5	0.0
2P2	5.7	7.0	0.0
2P3	5.4	8.0	0.0
2P4	6.8	9.5	3.5
2P5	7.0	10.0	3.0
2P6	6.8	9.0	0.0
2P7	7.9	9.5	3.0
2P8	6.7	9.5	2.0
2P9	5.9	7.0	0.0
2P10	n/a	n/a	n/a
2P11	7.1	9.0	3.5
2P12	6.4	9.2	2.0

Report from the Practical Classes Organiser
Materials Science 2nd year Practical Labs in 2018/19

I have reviewed the marks from the 2nd year Practicals from 2018-19. There is quite a wide range of overall average marks, assuming the standard penalties are applied, ranging from 16 to 83%, with an average of 67%. The unusually low minimum mark is from a student who didn't submit reports for 6 of the practicals but there are mitigating circumstances to be taken into account here. These general results are in line with past years records, with the exception of two unusually low performing students. The range of marks for an individual practical vary from practical to practical. They were all within 20% of each other.

Gender: I have assessed the marks for gender imbalance by looking to see who has received the highest and lowest marks for each practical. Male students consistently received the lowest marks and female students consistently received the highest marks, though as the same students consistently appear as either highest or lowest this suggest an accurate reflection of their performances. Female students exhibited 20% higher marks than their male counterparts on average.

Penalties: I have looked at the suggested penalties and am recommending that these are accepted in their entirety. Medical certificates were supplied by some students to cover late submission and penalties waived accordingly in line with the guidance in the course handbook. There are some cases deserving further comments:

- -Some candidates submitted their reports just seconds over the deadline. I suggest the "-1" penalty is waived since it is likely it is the consequence of a technical delay and they would have not gained any additional academic advantage.

Special cases:

- A candidate was suspended for a year and thus completed his MT & HT practicals in 2017/18 – we still assessed the 2P10 Materials Selection practical at this time so his/her mark calculation has been adjusted to take this into account.

- A student, currently suspended and expected to return in MT20, has been included in this report. All the practicals are complete so I think it makes sense for his/her results to be considered within this cohort.

- A student uploaded the wrong report for 2P6 (2P3 from the previous practical) but then sent the SD directly the correct report on realising the error, 10 days later. This was marked as normal. The student then uploaded report 2P11 instead of 2P4. This was caught by the admin team 2 days later and the correct report was submitted. In both cases, the document properties of the reports that should have been submitted showed final editing before the respective deadlines, suggesting a genuine error. I suggest this year we don't penalize the student. However, there are multiple warnings for students to check their work before submitting as strictly subsequent versions shouldn't be accepted. A formal summative assignment would require Proctorial approval before a replacement assignment could be submitted. What criteria (e.g. evidence of document properties) and on whose authorisation should subsequent submission be permitted?
  [Chair's Comment: See note on the following page]

- 2P8 TEM report late submission for one student (report due 22 June). Normal admin processes would report missing or late reports on a weekly basis to the college tutor. This report was due to be submitted on Saturday of week 8 (the group were given an extension as the JD had provided blank data). This was during the peak exam season and workload was compounded by staff resignations. Therefore, the lack of report was only identified on 15 July. The tutor then explored with the student who believed he had submitted the report by the deadline but on checking was unable to find the email confirming receipt (from WebLearn). He/she provided the report which showed document properties last edited 22 June. The student's tutor provided a statement of support (attached). Marking was duly arranged and the mark that would have been awarded is included in the spreadsheet. This was not released to the student. I suggest the student doesn't get a penalty for this late submission.

Some students require special considerations:

Student 1) submitted 2P2 and 2P9 one week late which ordinarily would incur -1 penalty mark each. However, at this time he/she was under personal circumstances that would justify this delay. I suggest the panel does not penalize these two late submissions. However, this student incurred in 3 further instances of late submissions throughout the year. After receiving the mark for the TEM practical (the last report of the year) he/she flagged that he/she had uploaded the wrong version of the report – a draft rather than the final version – but given the number of warnings about submitting the correct file it was felt that no action should be taken. (Although a similar issue was reported earlier with the recommendation to waive the penalties, there is less supporting evidence in this particular one)

Student 2) incurred proposed penalties for 6 of the 11 practicals and of these, 3 were submitted minutes before the absolute cut-off point for being able to gain marks (in accordance with the penalty structure laid out in the handbook). There is no evidence of mitigating circumstances received to date. College tutors were kept informed about the regular lateness.

Student 3) also exhibited a regular pattern of late or non-existent reports. Upon investigation by college it became aware that this was due to a condition for which it was deemed necessary to make reasonable adjustments. A formal proposal has been made for the examiners to consider with a supporting MCE.

Plagiarism: No cases of plagiarism were reported by the senior demonstrators.

Problems which occurred in the labs during the course of the year which the Examiners should be aware of as potentially affecting candidates' marks:

- During the Jan19 JCCU meeting, the students raised the issue of some of the recommended textbooks in the practical scripts not being available enough (or at all) in the department and college libraries. I have asked all SDs to review this list and update it as needed.
- The Jeol 3000F was used instead of the Jeol 2100 for part of the 2P8 practical. This affected the quality of some of the images obtained but the SDs took it into consideration. Additionally in 2P8, one group of students (Group 4) were given a blank data set in error. This was swiftly rectified and an equivalent extension to the delay was given for this group to submit their report, as compensation.

Practical Class Organiser – Sergio Lozano-Perez
June 2020

Chair's Remark:
On the previous page, the Practical Classes Organiser notes that one student uploaded the wrong report on two occasions. While the Organiser suggested that no penalties be applied, the Examiners were inclined to permit one incident as a mistake but apply penalties for lateness for any further incidents, based on when the correct report was made available. It is the Chair's recommendation that this be considered an appropriate stance in future, given the very clear instructions that the students receive.

Examination Conventions 2019/20
Materials Science - Final Honours School (Part I)
(revised to reflect the changes introduced for COVID-19 pandemic)

1. INTRODUCTION

Examination conventions are the formal record of the specific assessment standards for the course or courses to which they apply. They set out how examined work will be marked and how the resulting marks will be used to arrive at a final result, a progression decision and/or classification of an award.

These conventions apply to the Final Honours School in Materials Science for the academic year 2019-20; the entries in green font reflect the special measures and changes adopted to allow for the COVID-19 pandemic. The Department of Materials' Academic Committee (DMAC) is responsible for approving the Conventions and considers these annually, in consultation with the examiners. The formal procedures determining the conduct of examinations are established and enforced by the University Proctors. These Conventions are a guide to the examiners and candidates but the regulations set out in the Examination Regulations have precedence. Normally the relevant Regulations and MS FHS Handbook are the editions published in the year in which the candidate embarked on the FHS programme. The Examination Regulations may be found at: http://www.admin.ox.ac.uk/examregs/.

The paragraphs below indicate the conventions to which the examiners usually adhere, subject to the guidance of the appointed external examiners, and other bodies such as the Academic Committee in the Department, the Mathematical, Physical and Life Sciences Division, the Education Committee of the University and the Proctors who may offer advice or make recommendations to examiners.

The examiners are nominated by the Nominating Committee[1] of the Department and those nominations are submitted for approval by the Vice-Chancellor and the Proctors. Formally, examiners act on behalf of the University and in this role are independent of the Department, the colleges and of those who teach the MS M.Eng. programme. However, for written papers on Materials Science in Part I examiners are expected to consult with course lecturers in the process of setting questions.

2. RUBRICS AND STRUCTURE FOR INDIVIDUAL PAPERS

General Papers 1 – 4 are set by the examiners in consultation with course lecturers. The responsibility for the setting of each examination paper is assigned to an examiner, and a second examiner is assigned as a checker. Option papers are set by lecturers of the option courses and two examiners, the examiners acting as checkers.

The examiners, in consultation with lecturers, produce suggested exemplar answer and marking schemes for every question set, including a clear allocation of marks for each part or sub-part of every question. These are annotated to indicate what is considered 'book-work', what is considered to be 'new material' requiring candidates to extend ideas from what has been covered explicitly in the course, and what is considered to be somewhere in between. This enables the examiners to identify how much of the question is accessible to less strong candidates and the extent to which the question has the potential to differentiate among the very best candidates. The marking scheme for each question aims to ensure that weaker candidates can gain marks by answering some parts of the question, and stronger candidates can show the depth of their understanding in answering other parts. The wording and content of all examination questions set, and the suggested exemplar answer and marking schemes, are scrutinised by all examiners, including the external examiners. The marking schemes are approved by the examining board alongside the papers.

Examiners check that questions are of a consistent difficulty within each paper and between papers.

The structure, content and duration of the online open-book examination papers has been reviewed carefully by the examining board of internal and external examiners. In the main, the Part I examination questions that are used for revision purposes are already designed to assess understanding, rather than memory-recall of facts. This means that only some minor changes to the typical 'closed-book' format have been necessary to make them suitable to be sat as open-book.

[1] for the 2019-20 examinations the Nominating Committee comprised Prof Nellist, Prof Marrow & Dr Taylor.

Examiners proof read the final 'camera-ready' pdf version of each examination paper. Great care is taken to minimise the occurrence of errors or ambiguities, not least because of the awareness of the potential impact of the announcement of corrections during the examinations. Despite this care, on occasion an error does remain in a paper presented to candidates in the Exam Schools: if a candidate thinks there is an error or mistake in the paper, then they must state what they believe the error to be at the start of their answer to that question and if necessary, state their understanding of the question. The examiners will then consider the validity of the error and assess the impact of the error on candidates' choice of questions and on the answers written by those who attempted a question that contained an error, and will take this impact into account when marking the paper.

All General Papers comprise eight questions from which candidates attempt five. Each question is worth 20 marks. The maximum number of marks available on each general paper is 100.

Materials Option papers comprise one section for each twelve-hour Options lecture course, each section containing two questions: candidates are required to answer one question from each of any three sections and a fourth question drawn from any one of the same three sections. The maximum number of marks available on each option paper is 100, and all questions carry equal marks. Questions are often divided into parts, with the marks for each part indicated on the question paper.

3. MARKING CONVENTIONS

3.1 University scale for standardised expression of agreed final marks

Agreed final marks for individual papers will be expressed using the following scale: 0-100.

3.2 Qualitative criteria for different types of assessment

Qualitative descriptors, based on those used across the Mathematical, Physical and Life Sciences Division, are detailed below:

70-100	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. The higher the mark in this band the greater will be the extent to which these criteria will be fulfilled; for marks in the 90-100 range there will be no more than a very small fraction, circa 5-10%, of the piece of work being examined that does not fully meet all of the criteria that are applicable to the type of work under consideration. The 'piece of work' might be, for example, an individual practical report, a question on a written paper, or a whole written paper.
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.
40-49	The candidate shows reasonable understanding of at least part of the basic material and some problem solving skills. Although there may be a few good answers, the majority of answers 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 answers, but there will be indications of some competence.
0-29	The candidate shows inadequate grasp of the basic material. The work is likely to show major misunderstanding and confusion, and/or inaccurate calculations; the answers to most of the questions attempted are likely to be fragmentary.

3.3 Verification and reconciliation of marks

Part I Written Papers

During the marking process the scripts of all written papers remain anonymous to the markers. The markers are guided by the suggested exemplar answer and marking schemes.

All scripts are double marked, blind, by the setter and the checker each awarding an integer mark for each question. After individual marking the two examiners meet to agree marks question by question. If the differences in marks are small (~10% of the maximum available for the question, 2-3 marks for most questions), the two marks are averaged, with no rounding applied.

Otherwise the examiners identify the discrepancy and read the answer again, either in whole or in part, to reconcile the differences. If after this process the examiners still cannot agree, they seek the help of the Chairman, or another examiner as appropriate, to adjudicate. An integer total mark for each paper is awarded, where necessary rounding up to achieve this.

Options papers are marked by course lecturers acting as assessors and an examiner acting as a checker.

The external examiners provide an independent check on the whole process of setting and marking.

Part I Coursework

In some of the descriptions of marking for individual elements of *coursework* the term 'double marked, blind,' is used; this refers to the fact that the second marker does not see the marks awarded by the first marker until he or she has recorded his or her own assessment, and does not indicate that the candidate is anonymous to the markers.

(1) *Second Year Practicals*

Second year practicals are assessed continually by senior demonstrators in the teaching laboratory and in total are allocated a maximum of 60 marks. Part I examiners have the authority to set a practical examination.

(2) *Industrial Visits*

Four industrial visit reports should be submitted during Part I. Reports are assessed by the Industrial Visits Academic Organiser on a good / satisfactory / non-satisfactory basis, and are allocated a maximum of 20 marks. Guidance on the requirements for the reports is provided at the annual 'Introduction to Industrial Visits' talk. Formative feedback is provided on the first of the four reports.

(3) *Engineering and Society*

The business plan for "Entrepreneurship and new ventures" is double marked, blind, by two assessors appointed by the Faculty of Materials. The written business plan is allocated a maximum of 20 marks. Guidance on the requirements for the written business plan and an outline marking scheme are published in the FHS Course Handbook. Further guidance is provided at the 'Building a Business' tutorials, the slides from which are published on WebLearn.

If the Foreign Language Option or a Supplementary Subject has been offered instead of the Business Plan, the reported % mark, which is arrived at in accordance with the CVCP degree class boundary descriptors, is divided by five to give a mark out of 20.

(4) *Team Design Project*

The team design project is double marked, blind, by two of the Part I Examiners. They then compare marks and analyse any significant disagreement between these marks before arriving at a final agreed mark for each project and each team member. Supervisors of the projects submit a written report to the examiners on the work carried out by their teams and these are taken into consideration when the examiners decide the final agreed marks. Industrial representatives may be asked to contribute to the assessment process. The project is allocated a maximum of 50 marks, of which 25 are for the written report and 25 for the oral presentation. The same two examiners assess both the reports and the presentations. Guidance on the requirements for the report and an outline marking scheme are provided in the 'Team Design Projects Briefing Note' published on WebLearn

(5) *Advanced Characterisation of Materials and Introduction to Modelling in Materials Modules*

The reports for these modules are double marked, blind, by the module assessors. Normally, at least one of the two assessors for each report will be a module organizer. The assessors then compare marks and analyse any significant disagreement between these marks before arriving at a final agreed mark for each report. One of the Examiners oversees this process, sampling reports to ensure consistency between the different pairs of assessors and the two modules.

The lead organizer for the Characterisation Module submits to the Assessors and Examiners of the module a short report which provides, by sample set only, (i) a summary of the availability of appropriate characterization instruments during the two-week module and (ii) any other pertinent information. An analogous report is provided by the lead organizer for the Modelling Module in respect of the software & hardware required for each mini-project.

The Report for the Characterisation Module is allocated a maximum of 50 marks and each of the two reports for the Modelling Module is allocated a maximum of 25 marks. For each module, guidance on the requirements for the reports and an outline marking scheme are published on WebLearn.

3.4 Scaling

Part I Written Papers

To mitigate against any difficulties faced by the candidates as a result of the move to open-book examinations, the examiners propose to (i) base decisions on whether or not it is appropriate to consider scaling on the median marks for the papers or questions, rather the on the usual mean marks, and (ii) permit, should it be appropriate at all, only the scaling **up** of the marks for Part I papers, prohibiting scaling down of these marks.

As the total number of candidates is small, it is not unusual for mean marks to vary from paper to paper, or year to year. It is not therefore normal practice to adjust marks to fit any particular distribution. However, where marks for papers are unusually ~~high or~~ low, the examiners may, having reviewed the difficulty of the paper set or other circumstances, decide with the agreement of the external examiners to adjust all marks for those papers. Such adjustment is referred to as 'scaling' and the normal procedure will be as follows:

a. Papers with a *mean taken over all candidates* of less than 55% are normally adjusted to bring the *mean* respectively up to 55%. Normally this is achieved by adding the same fixed number of marks to each candidate's score for the paper.

b. For papers with a mean in the range of 55-60%, including those scaled under (a) above, the questions and typical answers are compared in order to ascertain, with the help of the external examiners, whether the marks are a fair reflection of the performance of the candidates as measured against the class descriptors. If not, the marks are adjusted. Normally this is achieved by adding the same fixed number of marks to each candidate's score for the question or for the paper.

c. The mean mark and the distribution of marks, both taken over all written papers, are considered, again with the help of the external examiners, in order to ascertain whether these overall marks are a fair reflection of the performance of the candidates as measured against the class descriptors. If not, the overall marks are adjusted. Normally this is achieved by adding the same fixed number of marks to each candidate's overall score.

Part I Coursework

Adjustment to marks, known as scaling, normally is not necessary for coursework.

The Practical Courses Organiser reviews the marks for the practicals before they are considered by the examiners, drawing to their attention (i) any anomalously low or high average marks for particular practicals and (ii) any factors that impacted on the practical course, such as breakdown of a critical piece of equipment. The examiners review the practical marks.

3.5 Short-weight convention and departure from rubric

Part I Written Papers

The rubric on each paper indicates a prescribed number of answers required (e.g. "candidates are required to submit answers to no more than five questions"). Candidates will be asked to indicate on a cover page which questions, up to the prescribed number, they are submitting for marking. If this information is not provided then the examiners will mark the questions in numerical order by question number. If the candidate lists more than the prescribed number of questions then questions will be marked in the order listed until the prescribed number has been reached. The examiners will NOT mark questions in excess of the prescribed number. If fewer questions than the prescribed number are attempted, (i) each missing attempt will be assigned a mark of zero, (ii) for those questions that are attempted **no** marks beyond the maximum per question indicated under section 2 above will be awarded and (iii) the mark for the paper will still be calculated out of 100. In addition, for the Materials Options Papers, as per the rubric, the examiners will mark questions from only three sections. Should a candidate attempt questions from more than three sections the examiners will mark those questions from the first three sections in the order listed by the candidate on the covering page. If this information is not provided then the examiners will mark the sections in alphabetical order by section delineator (section A, section B, etc.).

Part I Coursework

It is a requirement for candidates to submit an element of coursework for each of the following: Practical Classes; Industrial Visits; Engineering & Society Coursework (or substitution); Team Design Project; Advanced Characterisation of Materials or Introduction to Modelling in Materials. For the Practical Classes and Industrial Visits, the element of coursework comprises a set of reports: reports on four Industrial Visits and reports on twelve Practical Classes as specified in the Course Handbook. In these cases, a candidate must submit a report for each visit/practical in order to satisfy the examiners. Failure to complete satisfactorily one or more elements of Materials Coursework normally will constitute failure of Part I of the Second Public Examination. Further details about this are provided in the Course Handbook.

3.6 Late- or non-submission of elements of coursework

Including action to be taken if submission has been or will be affected by illness or other urgent cause, and circumstances in which academic penalties may be applied.

The Examination Regulations prescribe specific dates and times for submission of the required elements of coursework to the Examiners (1. One piece of Engineering & Society Coursework; 2. A set of eleven reports of practical work as specified in the Course Handbook (normally each individual report within the set has been marked already as the laboratory course progresses - penalties for late submission of an individual practical report are prescribed in the Course Handbook and are applied prior to any additional penalties incurred under the provision of the present Conventions.); 3. A Team Design Project Report and associated oral presentation; 4. A set of four Industrial Visit Reports as specified in the course handbook; 5. A report on the work carried out in either the Advanced Characterisation of Materials module or the Introduction to Modelling in Materials module; and 6. A Part II Thesis). Rules governing late submission of these six elements of coursework and any consequent penalties are set out in the 'Late submission and non-submission of a thesis or other written exercise' clause of the 'Regulations for the Conduct of University Examinations' section of the Examination Regulations (Part 14, 'Late Submission, Non-submission, Non-appearance and Withdrawal from Examinations' in the 2019/20 Regulations). A candidate who fails to submit an element of coursework by a prescribed date and time will be notified of this by means of an email sent on behalf of the Chair of Examiners.

Under the provisions permitted by the regulation, late submission of an element of coursework, as defined above, for Materials Science examinations will normally result in one of the following:

(a) Under paras 14.4 to 14.8. In a case where illness or other urgent cause has prevented or will prevent a candidate from submitting an element of coursework at the prescribed date, time and place the candidate may, **through their college**, request the Proctors to accept an application to this effect. In such circumstances the candidate is **strongly** advised to (i) carefully read paras 14.4 to 14.8 of the aforesaid Part 14, where the mandatory contents of such an application to the Proctors are outlined and the several

possible actions open to the Proctors are set out, and (ii) both seek the guidance of their college Senior Tutor and inform at least one of their college Materials Tutorial Fellows. Some, but not all, of the actions open to the Proctors may result in the work being assessed as though it had been submitted on time (and hence with no late submission penalty applied).

(b) Under para 14.9. In the case of submission on or after the prescribed date for the submission and within 14 calendar days of notification of non-submission and without prior permission from the Proctors: subject to leave from the Proctors to impose an academic penalty, for the first day or part of the first day that the work is late a penalty of a reduction in the mark for the coursework in question of up to 10% of the maximum mark available for the piece of work and for each subsequent day or part of a day that the work is late a further penalty of up to 5% of the maximum mark available for the piece of work; the exact penalty to be set by the Examiners with due consideration given to the circumstances as advised by the Proctors. The reduction may not take the mark below 40%.

(c) Under Para 14.4(4). In the case of failure to submit within 14 calendar days of the notification of non-submission and without prior permission from the Proctors: a mark of zero shall be recorded for the element of coursework and normally the candidate will have failed Part I of the Examination as a whole.

Elements of coursework comprising more than one individual piece of assessed coursework

Penalties for late submission of individual practical reports are set out in the 2018/19 MS FHS Handbook and are **separate** to the provisions described above.

The consequences of failure to submit individual practical reports or failure to submit/deliver other individual pieces of assessed coursework that contribute to one of the *elements* of coursework scheduled in the Special Regulations for the Honour School of Materials Science are set out in the MS FHS Handbook (sections 7 and 10.7 of the 2018/19 version) and are **separate** to the provisions described above. In short normally this will be deemed to be a failure to complete satisfactorily the relevant element of Materials Coursework and will therefore constitute failure of Part I of the Second Public Examination.

Where an individual practical report or other individual piece of assessed coursework that contributes to one of the *elements* of coursework scheduled in the Special Regulations for the Honour School of Materials Science is not submitted or is proffered so late that it would be impractical to accept it for assessment the Proctors may, exceptionally, under their general authority, and after (i) making due enquiries into the circumstances and (ii) consultation with the Chairman of the Examiners, permit the candidate to remain in the examination. In this case *for the individual piece of coursework in question* (i) the Examiners will award a mark of zero and (ii) dispensation will be granted from the Regulation that requires submission/delivery of every individual piece of assessed coursework if the candidate is not to fail the examination as a whole.

3.7 Penalties for over-length work and departure from approved titles or subject-matter

For elements of coursework with a defined word limit: if a candidate exceeds this word limit without permission normally the examiners will apply a penalty of 10% of the maximum mark available for the piece of work. [It is only possible to apply for permission to exceed a word limit if the Examination Regulations for the specific element of coursework concerned state explicitly that such an application is permitted, excepting that the Proctors may, exceptionally, under their general authority grant such permission.]

3.8 Penalties for poor academic practice

Substantial guidance is available to candidates on what constitutes plagiarism and how to avoid committing plagiarism (see Appendix B of the 2018/19 FHS Course Handbook and https://www.ox.ac.uk/students/academic/guidance/skills/plagiarism?wssl=1)

If plagiarism is suspected, the evidence will be considered by the Chair of the Examiners (or a deputy). He or she will make one of three decisions (http://www.admin.ox.ac.uk/media/global/wwwadminoxacuk/localsites/educationcommittee/documents/policyguidance/Plagiarism_procedures_guidance.pdf):

(a) No evidence, or insufficient evidence, of plagiarism – no case to answer.

(b) Evidence suggestive of more than a limited amount of low-level plagiarism – referred to the Proctors for investigation and possible disciplinary action.

(c) Evidence proving beyond reasonable doubt that a limited amount of low-level plagiarism has taken place – in this case the Board of Examiners will consider the case and if they endorse the Chair's judgement that a limited amount of low-level plagiarism has taken place will select one of two actions:

(i) Impose a penalty of 10% of the maximum mark available for the piece of work in question and a warning letter to be issued to the candidate explaining the offence and that the present incident will be taken into account should there be a further incidence of plagiarism. For a student who remains on course in addition there will be a requirement to demonstrate to their college Materials Tutorial Fellow that in the period between the present offence and the next submission of work for summative assessment they have followed to completion the University's on-line course on plagiarism (https://www.ox.ac.uk/students/academic/guidance/skills/plagiarism?wssl=1).

(ii) No penalty, but a warning letter to be issued to the candidate explaining the offence, indicating that on this occasion it has been treated as a formative learning experience, and that the present incident will be taken into account should there be a further incidence of plagiarism. For a student who remains on course in addition there will be a requirement to demonstrate to their college Materials Tutorial Fellow that in the period between the present offence and the next submission of work for summative assessment they have followed to completion the University's on-line course on plagiarism (https://www.ox.ac.uk/students/academic/guidance/skills/plagiarism?wssl=1).

For the open-book exams, candidates are expected to observe the Honour Code:

Candidates are permitted to:

- refer to their own course and revision notes; and
- access offline or online resources, for example textbooks or online journals.

Candidates are expected to:

- submit work which has not been submitted, either partially or in full, either for their current Honour School or qualification, or for another Honour School or qualification of this University (except where the Special Regulations permit this), or for a qualification at any other institution; and
- indicate clearly the presence of all material they have quoted from other sources, including any diagrams, charts, tables or graphs. Candidates are not expected to reference, however if they provide a direct quote, or copy a diagram or chart, they are expected to make some mention of the source material as they would in a typical invigilated exam.
- paraphrase adequately all material in their own words

Candidates are required to confirm as part of each submission:

- that the work they are submitting for the open-book examination is entirely their own work, except where otherwise indicated; and
- that they have not copied from the work of any other candidate, nor consulted or colluded with any other candidate during the examination.

3.9 Penalties for non-attendance

Unless the Proctors have accepted a submission requesting absence from an examination, as detailed in Section 14 of the Regulations, failure to attend a written examination in Part I or the *viva voce* examination in Part II will result in the failure of the whole Part.

3.10 Penalties for late submission of open-book examination scripts

Candidates should upload their submission within the time allowed for their open-book examination. Candidates who access the paper later than the published start time (and who do not have an agreed alternative start time) will still need to finish and submit their work within the originally published

timeframe or be considered to have submitted late. Candidates who access the paper on time but who submit their work after the published timeframe will also be considered to have submitted late.

Where candidates submit their examination after the end of the specified timeframe and believe they have a good reason for doing so, they may submit a mitigating circumstances notice to examiners to explain their reasons for the late submission. The Exam Board will consider whether to waive the penalties (outlined below) for late submission.

The penalties will be applied at the paper level and are as follows:

Time	**Penalty**
First 15 minutes	No penalty
16 minutes – 30 minutes	5 marks or 5% of marks available (if not marked on 100 mark scale)
31 minutes – 45 minutes	10 marks or 10% of marks available (if not marked on 100 mark scale)
Up to an hour	15 marks or 15% of marks available (if not marked on 100 mark scale)
After one hour	Fail mark (0)

Penalties will only be applied after the work has been marked and the Exam Board has checked whether there are any valid reasons for late submission.

4. PROGRESSION RULES AND CLASSIFICATION CONVENTIONS

4.1 Qualitative descriptors of classes (FHS)

The following boundaries (CVCP) and descriptors (MPLSD) are used as guidelines:

Class I Honours 70 – 100	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.
Class II(i) Honours 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.
Class II(ii) Honours 50 – 59	The candidate shows basic problem-solving skills and adequate knowledge of most of the material.
Class III Honours 40 - 49	The candidate shows reasonable understanding of at least part of the basic material and some problem solving skills. Although there may be a few good answers, the majority of answers will contain errors in calculations and/or show incomplete understanding of the topics.
Pass 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 answers, but there will be indications of some competence.
Fail 0 - 29	The candidate shows inadequate grasp of the basic material. The work is likely to show major misunderstanding and confusion, and/or inaccurate calculations; the answers to most of the questions attempted are likely to be fragmentary only.

In reaching their decisions the examiners are not permitted to refer to a candidate's outcome in, or profile across the assessments in, the First Public Examination ('Prelims').

In borderline cases the examiners use their discretion and consider the quality of the work the candidate has presented for examination over the whole profile of FHS assessments; thus for Part I outcomes the Part I assessments, and for overall degree outcomes the assessments for both Parts I and II. The external examiners often play a key role in such cases.

4.2 Classification rules (FHS)

Part I:

In 2019/20, a candidate is allowed to proceed to Part II if he/she has satisfied the examiners in all elements of coursework assessment for the Part I Examination. An interim examination board will meet to review these marks in Trinity Term. The provisional marks will be released to the candidates but it should be noted that these will only be ratified when the examiners meet to consider the marks for the Part I written papers, and therefore may be subject to change.

At this Examination Board, the examiners are required to classify each candidate according to her/his overall average mark in Part I as (a) worthy of Honours, (b) Pass or (c) Fail. The examiners do not divide the categories further but tutors and students may infer how well they have done from their marks.

Unclassified Honours –A candidate is allowed to proceed to Part II ~~only~~ if he/she has been adjudged worthy of honours by the examiners in Part I and normally obtained a minimum mark of 50% averaged over all elements of assessment for the Part I Examination.

Candidates adjudged worthy of honours and obtaining a minimum mark of 50% averaged over all elements of assessment for the Part I Examination normally proceed to Part II but they may, if they wish and subject to approval from the relevant bodies, leave after Part I in which case an Unclassified Honours B.A. degree will be awarded.

Candidates adjudged worthy of honours who do not obtain a minimum mark of 50% averaged over all elements of assessment for the Part I Examination may (i) proceed to Part II, or (ii) retake Part I normally in the next examining session (Trinity Term 2021), or (iii) if they wish and subject to approval from the relevant bodies, leave after Part I in which case an Unclassified Honours B.A. degree will be awarded.

Pass – The examiners consider that the candidate is not worthy of honours and therefore will not be allowed to proceed to Part II.-The candidate may (i) retake Part I, normally in the next examining session (Trinity Term 2021) and the Part II project in 2020/21 would be terminated, or (ii) may leave with a B.A. (without honours) **and** opt to be considered for Declared to have Deserved Honours.

Fail – The examiners consider that the candidate is not worthy of a B.A. The candidate either leaves without a degree or may retake Part I normally in the next examining session (Trinity Term 2021), subject to college approval.

4.3 Progression rules

In 2019/20, a candidate is allowed to proceed to Part II if he/she has satisfied the examiners in all elements of coursework assessment for the Part I Examination. An interim examination board will meet to review these marks in Trinity Term. The provisional marks will be released to the candidates but it should be noted that these will only be ratified when the examiners meet to consider the marks for the Part I written papers, and therefore may be subject to change. Any candidate who has failed to satisfy the examiners in all elements of coursework assessment will be alerted to this.

No candidate for the degree of Master of Engineering in Materials Science may present him or herself for examination in Part II unless he or she has (a) been adjudged worthy of Honours by the Examiners in Part I.

To achieve Honours at Part I normally a candidate must fulfil all of the requirements under (a), (b) & (c) of this clause. (a) Obtain a minimum mark of 40% averaged over all elements of assessment for the Part I Examination, (b) obtain a minimum mark of 40% in each of at least four of the six written

papers sat in Trinity Term of the year of Part I of the Second Public Examination, and (c) satisfy the coursework requirements set out in Section B, Part I [of the Regulations].

In the assessment of the Materials coursework, the Examiners shall take into consideration the requirement for a candidate to complete satisfactorily the coursework to a level prescribed from time to time by the Faculty of Materials and published in the Course Handbook. Normally, failure to complete satisfactorily all five elements of Materials Coursework will constitute failure of Part I of the Second Public Examination.

4.4 Use of vivas

There are no vivas in the Part I examination.

5. RESITS

In the event that a candidate obtains a mark of less than 50% averaged over all elements of assessment of Part I, or if a candidate fails to satisfy the examiners, a resit is permitted. [A candidate who obtains a mark of less than 50% but obtains 40% or more may choose to continue with Part II or resit Part I.] Such a candidate may re-enter for the whole of the Part I examination on one occasion only, normally in the examining session in Trinity Term 2021, following the examiners' original decision. The examination will be identical to that taken by the other Part I candidates in said academic year. If such a candidate is adjudged worthy of honours and achieves a mark of 50% or more averaged over all elements of assessment in Part I, the candidate may progress to Part II but will carry forward only a capped mark of 50% for Part I.

Part II may be entered on one occasion only.

6. MITIGATING CIRCUMSTANCES NOTICES TO EXAMINERS (MCE)

[For **late- or non-submission** of elements of coursework, including cases due to illness or other urgent cause, see section 3.6 of the present Conventions.]

A candidate's final outcome will first be considered using the classification rules/final outcome rules as described above in section 4, with the use of any scaling that might be required to mitigate against any difficulties faced by the candidates as a result of the move to open-book examinations. The exam board will then consider any further information they have on individual circumstances.

Part 13 Mitigating Circumstances: Notices to Examiners section of the University's *Examination Regulations* relates to unforeseen circumstances which may have an impact on a candidate's performance.

Where a candidate or candidates have made a submission, under Part 13 of the Regulations for Conduct of University Examinations, that unforeseen circumstances may have had an impact on their performance in an examination, the internal examiners 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.

For Part I, normally, this MCE meeting will take place before Part A of the meeting of the internal examiners at which the examination results are reviewed. When reaching these Part I decisions on MCE impact level, the internal examiners will take into consideration, on the basis of the information received, the severity and relevance of the circumstances, and the strength of the evidence provided in support. Examiners will also note whether all or a subset of written papers and/or elements of coursework were affected, being aware that it is possible for circumstances to have different levels of impact on different written papers and elements of coursework. The banding information is used at Part B of the meeting of the Part I internal examiners at which the examination results are reviewed: in Part B a candidate's results are discussed in the light of the impact of each MCE and recommendations to the Finals Board formulated regarding any action(s) to be taken in respect of each MCE.

Further information on the procedure is provided in the *Examination and Assessment Framework, Annex E* and information for students is provided at www.ox.ac.uk/students/academic/exams/guidance. It is very important that a candidate's MCE

submission is adequately evidenced and, where appropriate, verified by their college; the University forbids the Board of Examiners from seeking any additional information or evidence.

Candidates who have indicated they wish to be considered for DDH/DDM will first be considered for a classified degree, taking into account any individual MCE. If that is not possible and they meet the DDH/DDM eligibility criteria, they will be awarded DDH/DDM.

7. DETAILS OF EXAMINERS AND RULES ON COMMUNICATING WITH EXAMINERS

The Materials Science Examiners in Trinity 2020 are: Prof. Hazel Assender, Prof. Simon Benjamin (Chair), Prof. James Marrow, Prof. Pete Nellist, Prof. Roger Reed and Prof. Richard Todd. The external examiners are Prof. Alison Davenport, University of Birmingham, and Prof. Peter Haynes, Imperial College, London.

It must be stressed that to preserve the independence of the examiners, candidates are not allowed to make contact directly about matters relating to the content or marking of papers. Any communication must be via the candidate's college, who will, if the matter is deemed of importance, contact the Proctors. The Proctors in turn communicate with the Chairman of Examiners.

Candidates should not under any circumstances seek to make contact with individual internal or external examiners.

ANNEX

Summary of maximum marks available to be awarded for different components of the MS Final Examination in 2020 (For Part I students who embarked on the FHS in 2018/19)

	Component	**Mark**
Part I	General Paper 1	100
	General Paper 2	100
	General Paper 3	100
	General Paper 4	100
	Materials Options Paper 1	100
	Materials Options Paper 2	100
	Practicals	60
	Industrial visits	20
	Engineering and Society coursework	20
	Team Design Project	50
	Characterisation or Modelling module	50
Part I Total		*800*
Part II	Thesis	400
Overall Total		*1200*

REPORT ON FINAL HONOURS SCHOOL OF MATERIALS SCIENCE, PART II EXAMINATION

Part I

A. STATISTICS

(1) **Numbers and percentages in each category**

Candidates are given a mark on the basis of their performance in the Part II examination and then given a classification on the basis of their performance across Part I and Part II.

Class	Number			Percentage (%)		
	2019/20	2018/19	2017/18	2019/20	2018/19	2017/18
I	19	11	9	57.6	34.4	31.0
II.I	12	17	16	36.4	53.1	55.2
II.II	2	2	3	6.0	6.0	10.4
III	-	1	1	0	3.0	3.4
Pass	-	0	0	0	0	0
Fail	-	1	0	0	3.0	0
Total	33	32	29	-	-	-

(2) **The use of vivas**
In 2020 there were several changes to the arrangements for vivas which had been largely unchanged for several years. However the fundamental principles and purpose of the viva remained the same: as opportunities for the Examiners/Assessors who had marked the thesis to clarify points regarding the thesis and, of course, to verify that the work was the candidate's own. Therefore, as in previous years, the mark for the Part II was on the thesis rather than the viva.

The new methods and procedures used in 2020 are described in B below.

(3) **Marking of theses**
All theses were double blind marked by two internal Examiners or an internal Examiner and Assessor, and were inspected by one external. Due to the modest number of candidates, which makes it easy to identify who is working on a particular research topic, anonymous marking is not possible. Provisional marks were exchanged in advance of the viva, to allow a brief discussion of differences of assessment, which if necessary could be explored further during the viva. Following the viva, a final agreed mark was decided between the examiners/assessor who were present. The two internal Examiners/Assessors who read the thesis provided the greatest input to the decision making process.

B. NEW EXAMINING METHODS AND PROCEDURES

The new methodology for 2020 was of two kinds: Measures that the Department had resolved to introduce prior to the Covid pandemic, and those that were in response to the pandemic.

Under the former heading two things should be noted:

- For the first time, the vivas were arranged to take place in two parallel streams. Thus, it was no longer possible (even in principle) for all Examiners to be present for all vivas.

- A more formal record keeping was adopted whereby every viva had a written record generated. In each viva were (at least) the two Examiners (or one Examiner and one Assessor, see below), who had read the thesis in detail and arrived at a provisional mark; a Chair for the session whose responsibility included logging the key aspects of the viva on a new form; an external examiner to monitor the proceedings and participate in the questions as appropriate. After the candidate was excused at the end of the viva, these individuals consulted to agree upon a final mark.
  A template of the report form that was completed by each session Chair is included in this report.

- As sometimes occurred in previous years, Assessors were used in order to balance the workload for the Examiners. There were three Assessors and these individuals (Department staff members who were not currently examiners) fulfilled an equivalent role to the Examiners themselves, i.e. marking a number of theses in detail and participating in the vivas. Note however that at most one of the two individuals who read a given thesis would be an Assessor, i.e. there was always at least one Examiner.

Regarding the adaptions made in view of the Covid pandemic, the following should be noted:

- The vivas were carried out over MS Teams. As part of this protocol, a preparatory call was made to students in the previous days to ensure the link would work, and as a backup phone numbers were available.

- A 'safety net' was imposed for the final degree classification process, whereby a candidate's assigned class would be the higher of (a) the classification that would follow from considering both Part I and Part II in the normal manner, (b) the classification that would result from considering Part I alone, effectively negating the impact of a low-scoring Part II. Although this measure could in principle make very significant alterations to the exam outcomes, in fact it was only employed in a few marginal cases.

It is the Chair's opinion that all these changes were appropriate and that none of them had any deleterious effect on the integrity or fairness of the FHS exam process. Obviously the 'safety net' was an extraordinary measure taken in response to the disruption and uncertainty endured by the 2020 cohort; it will presumably not be used in future years. However the other changes, i.e. parallel streams, record keeping, Assessors to keep the Examiners workload from exceeding ~8 theses, and indeed the MS Teams mechanism for vivas, were appropriate for adoption in an on-going model.

Specimen record form used at Part II Viva

CONFIDENTIAL: FHS Materials Science – Record of Content of Part II Viva

CANDIDATE NAME:		**Yes**	**Not selected**	**Comment (attach extra page if needed)**
The following areas were identified for questions during the candidate's viva:				
1.	Aims and objectives of the project			
2.	Understanding of the material			
3.	Original thought and contribution to project			
4.	Knowledge of other material in the field			
5.	Explanation and definition of the choice of methodology			
6.	Understanding of the results in the data collection process			
7.	Problem solving			
8.	Critical appreciation of the results			
9.	Project management			
10.	i) Risk Assessment and Health & Safety ii) Ethics & Sustainability iii) The Engineering Context			
The examiners were satisfied that the Part II report was the candidate's own work		**Yes**	**No**	
Overall comments with rationale for agreed final mark:				

FINAL MARK	

ALL MEMBERS OF THE PANEL WERE PRESENT AS PER THE VIVA SCHEDULE ..... YES / NO Comments:

Chair of Viva: .....

Signature:..... **Date:** .....

C. CHANGES IN EXAMINING METHODS, PROCEDURES AND CONVENTIONS WHICH THE EXAMINERS WOULD WISH THE FACULTY AND THE DIVISIONAL BOARD TO CONSIDER

As noted in B above, some of the changes in 2020 had been scheduled even prior to the Covid pandemic and presumably these, at least, will remain going forward.

In this context it is worth mentioning that the use of parallel streams introduces a new challenge for ensuring conformity of the viva experience. Generally it was felt by both the Internal and External Examiners that the conformity was good in the 2020 vivas, however it is certainly something to focus upon as the potential for inconsistent treatment of students does exist.

D. EXAMINATION CONVENTIONS

The current year's Conventions (adapted to reflect the changes due to the COVID-19 pandemic) were put on the Departmental website and sent electronically to all candidates on 13 June 2020. The Examination Conventions were assessed by the Board of Examiners and the Department's Academic Committee.

Part II

A. GENERAL COMMENTS ON THE EXAMINATION

Of the 33 candidates whose results were ratified by the examiners all were awarded Honours. The examination required the candidates to submit a thesis (maximum 12,000 words) on a research project carried out by candidates during the year, usually in the Department of Materials. Candidates were given a 25 minute viva, during which they were asked detailed questions on their thesis and research work.

The theses were mostly of a high quality, and the candidates were able to explain their work well in the vivas. The marks for the Part II examination ranged from 56% to 90% with an overall mean mark at the low end of the 1st class range. The External Examiners played an important role in the discussions that lead to the decisions on the final marks for the candidates and the Chair would like to express his thanks to both of them for their hard work in inspecting the substantial number of Part II theses and contributing to the vivas.

Due to the larger number of students to be examined at Part II this year, three assessors were appointed in addition to the six examiners. Chair's narrative on this point and on other elements appear earlier in "B. NEW EXAMINING METHODS AND PROCEDURES".

B. EQUAL OPPORTUNITIES ISSUES AND BREAKDOWN OF THE RESULTS BY GENDER

Insofar as can be judged from the small sample size, the performance of male and female candidates was not significantly different. However, as noted by one of the External Examiners, the female students' marks were more clustered (albeit with a good mean) whereas the male students' spectrum of marks included both weaker theses and the very strongest examples. **While the sample size here is small, this may be something that future Examiners may wish to monitor.**

One candidate sought – and was granted - approval for an increased word limit due to an SpLD. There were no other applications for consideration for specific learning difficulties made for the Part II component of the exam process this year (although a Form 2D alerting the examiners to an SpLD of some sort was included where appropriate).

	Overall mark (allowing for 'safety net')		Part 2 Project		Part I Mark	
mark (%)	Male	Female	Male	Female	Male	Female
30-40	-	-	-	-	-	-
40–50	1	-	-	-	1	-
50–60	1	-	3	1	3	1
60–70	11	4	10	-	9	3
70–80	11	1	10	5	12	1
80–90	3	1	3	-	2	1
90-100	-	-	1	-		
Totals	27	6	27	6	27	6

C. DETAILED NUMBERS ON CANDIDATES' PERFORMANCE IN EACH PART OF THE EXAMINATION

All candidates took the same examination, producing a thesis and attending a viva. The statistics on the final marks for both Part I (2019) and Part II for these candidates are given above.

D. COMMENTS ON PAPERS AND INDIVIDUAL QUESTIONS

Comments on the overall candidates' performance in the Part II coursework are attached.

E. COMMENTS ON THE PERFORMANCE OF IDENTIFIABLE INDIVIDUALS AND OTHER MATERIALS WHICH WOULD USUALLY BE TREATED AS RESERVED BUSINESS

(1) Mitigating Circumstance: Notices to Examiners.

32 applications for consideration of Mitigating Circumstances: Notices to Examiners were submitted. [redacted]

[redacted]			

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(2) Comment on table in part IIB.

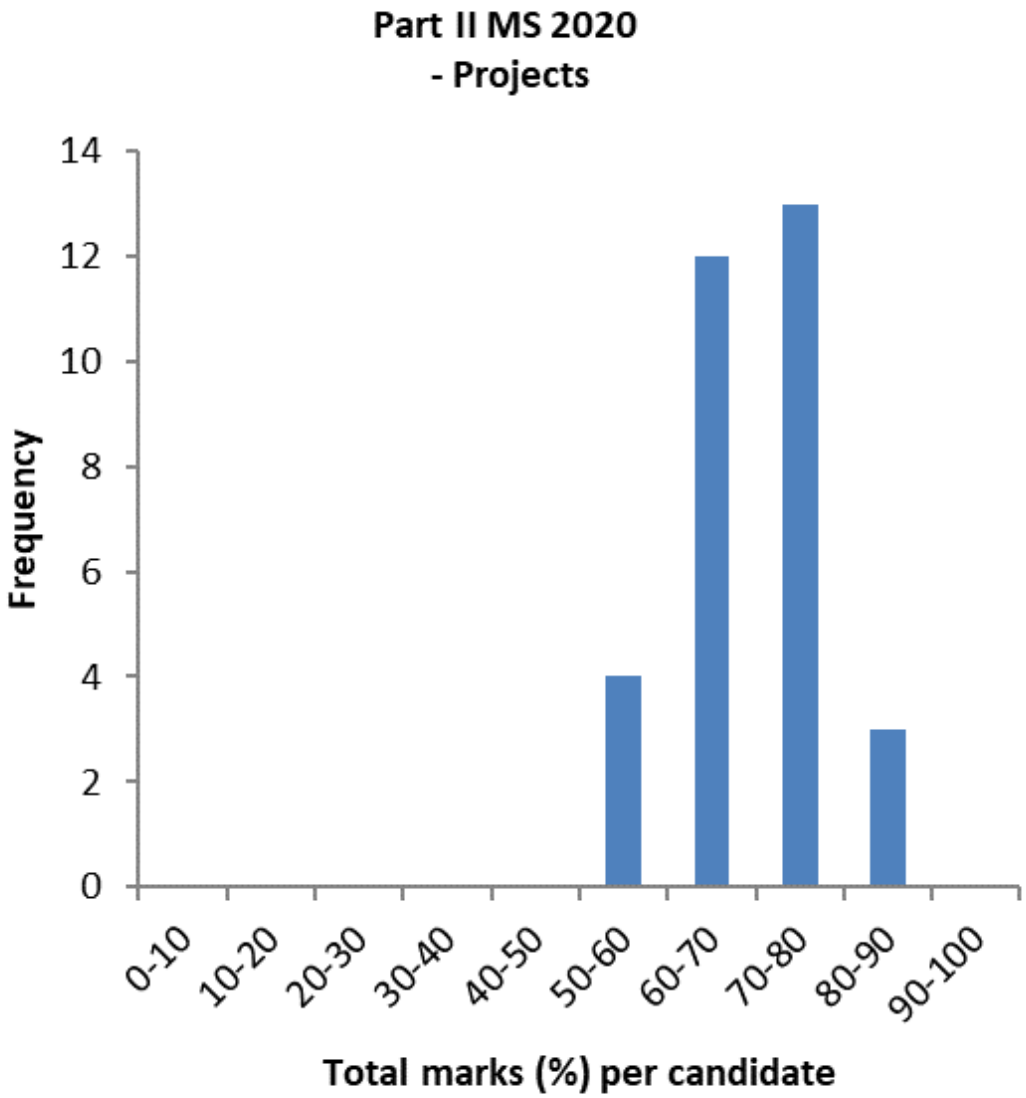
F. NAMES OF MEMBERS OF THE BOARD OF EXAMINERS

Prof. H.E, Assender	Prof. S.C. Benjamin (Chair)
Prof. T.J. Marrow	Prof. P.D. Nellist
Prof. R.C. Reed	Prof. R.I. Todd
Prof. A.J. Davenport (external)	Prof. P.D. Haynes (external)

Report on Part II Projects

Candidates: **33**
Mean mark: **70%**
Maximum mark: **90%**
Minimum mark: **56%**

Detailed comments on the paper are as follows:



General Comments

When considering these comments, see also the Chair's narrative "B. NEW EXAMINING METHODS AND PROCEDURES".

As in previous years, the great majority of the Part II theses were of a very high standard, and this was stressed by the External Examiners.

Obviously 2020 was an extraordinary year for both students and staff, and for the Part II cohort this was acutely obvious since many (indeed, most) of the candidates had found that their practical research was curtailed just at the time when they had attained full competence in the required skills. Even students who were undertaking more theorical/modelling orientated projects had typically suffered impacts, as computer systems where less reliably maintained and moreover access to the expert advice of supervisors and group members was more constrained. Obviously, full account of these difficulties was taken by the Examiners and Assessors.

The students were asked to submit, as part of their thesis but outside of the core word count constraint, a 'Reflective Account' describing the impact of the covid-19 pandemic on the progress of their project. This was invaluable for the markers but moreover the authoring of this section evidently offered some catharsis for the students as they struggled to maximise the coherence of their disrupted projects.

One of the External Examiners suggested that the Department might review the format of the thesis at a fundamental level: The suggestion was that the thesis might benefit from more closely mirroring the structure of a scientific paper (rather than a full doctoral thesis), with the consequent rebalancing of the emphasis between background context and the direct account of research. This is an interesting point to consider when next the Department reviews the thesis structure required of students.

Examination Conventions 2019/20
Materials Science - Final Honours School (Part II)
(revised to reflect the changes introduced for COVID-19 pandemic)

1. INTRODUCTION

Examination conventions are the formal record of the specific assessment standards for the course or courses to which they apply. They set out how examined work will be marked and how the resulting marks will be used to arrive at a final result, a progression decision and/or classification of an award.

These conventions apply to Part II of the Final Honours School in Materials Science for the academic year 2019-20; the entries in green font reflect the special measures and changes adopted to allow for the COVID-19 pandemic. The Department of Materials' Academic Committee (DMAC) is responsible for approving the Conventions and considers these annually, in consultation with the examiners. The formal procedures determining the conduct of examinations are established and enforced by the University Proctors. These Conventions are a guide to the examiners and candidates but the regulations set out in the Examination Regulations have precedence. Normally the relevant Regulations and MS FHS Handbook are the editions published in the year in which the candidate embarked on the FHS programme. The Examination Regulations may be found at: http://www.admin.ox.ac.uk/examregs/.

The paragraphs below indicate the conventions to which the examiners usually adhere, subject to the guidance of the appointed external examiners, and other bodies such as the Academic Committee in the Department, the Mathematical, Physical and Life Sciences Division, the Education Committee of the University and the Proctors who may offer advice or make recommendations to examiners.

The examiners are nominated by the Nominating Committee[2] of the Department and those nominations are submitted for approval by the Vice-Chancellor and the Proctors. Formally, examiners act on behalf of the University and in this role are independent of the Department, the colleges and of those who teach the MS M.Eng. programme. However, for written papers on Materials Science in Part I examiners are expected to consult with course lecturers in the process of setting questions.

2. RUBRICS AND STRUCTURE FOR INDIVIDUAL PAPERS
[Not relevant for Part II - There are no timed written papers for the Part II FHS.]

3. MARKING CONVENTIONS

3.1 University scale for standardised expression of agreed final marks

Agreed final marks for individual papers will be expressed using the following scale: 0-100.

3.2 Qualitative criteria for different types of assessment

Qualitative descriptors, based on those used across the Mathematical, Physical and Life Sciences Division, are detailed below:

70-100	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. The higher the mark in this band the greater will be the extent to which these criteria will be fulfilled; for marks in the 90-100 range there will be no more than a very small fraction, circa 5-10%, of the piece of work being examined that does not fully meet all of the criteria that are applicable to the type of work under consideration. The 'piece of work' might be, for example, an individual practical report, a question on a written paper, or a whole written paper.
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.

[2] for the 2019-20 examinations the Nominating Committee comprised Prof Nellist, Prof Marrow & Dr Taylor.

50-59	The candidate shows basic problem-solving skills and adequate knowledge of most of the material.
40-49	The candidate shows reasonable understanding of at least part of the basic material and some problem solving skills. Although there may be a few good answers, the majority of answers 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 answers, but there will be indications of some competence.
0-29	The candidate shows inadequate grasp of the basic material. The work is likely to show major misunderstanding and confusion, and/or inaccurate calculations; the answers to most of the questions attempted are likely to be fragmentary.

3.3 Verification and reconciliation of marks

Part II Coursework

The Part II project is assessed by means of a thesis which is submitted online to the Examiners, who will also take into account a written report from the candidate's supervisor. The marking criteria are published in the Part II Course Handbook.

The Supervisor's report is divided into Parts A & B: Part A provides simple factual information that is of significance to the examiners, such as availability of equipment and the impact on the candidate's **project** of the COVID-19 pandemic, and is seen by the two markers before they read and assess the thesis. Part A does **not** include personal mitigating circumstances which, subject to guidance from the Proctors, normally are considered only in discussion with **all** Part II examiners thus ensuring equitable treatment of all candidates with mitigating circumstances. Part B of the supervisor's report provides her/his opinion of the candidate's engagement with the project and covers matters such as initiative and independence; it is not seen by the examiners until the discussion held after the viva.

The project is allocated a maximum of 400 marks, which is one third of the maximum available marks for Parts I and II combined. Two Part II examiners read the thesis (including the final chapter with the reflective accounts of project management, health, safety & risk assessment processes, and ethical and sustainability considerations), together with Part A of the supervisor's report, and each of them independently allocates a provisional mark based on the guidelines***** published in the course handbook. In addition, normally the thesis will be seen by one of the two external examiners.

A *viva voce* examination is held using video-conferencing technology: the purpose of the viva is to clarify any points the readers believe should be explored, and to ascertain the extent to which the work reported is the candidate's. Any examiners who have supervised the candidate's Part II project or are their college tutor will not be present for the viva or the subsequent discussion. Normally four individuals will have specified examining roles: Two examiners, or one examiner and an assessor, who have read the thesis entirely; the external examiner to whom the thesis was assigned; and an examiner acting as the session Chair who will complete the Viva Record form for that viva. A discussion involving all examiners present is held after the viva, during which Part B of the supervisor's report is taken into account. The outcome of the discussion is an agreed mark for the project. In arriving at the agreed mark the Examiners will take into account all of the following, (i) the comments and provisional marks of the original markers, (ii) the candidate's understanding of their work as demonstrated during the viva and (iii) the opinion of the external examiner who has seen the thesis.

If the two provisional marks allocated in advance of the viva differ significantly (that is, normally by more than 10% of the maximum available for a Part II project) this will be addressed explicitly during the discussion after the viva. In the majority of other cases the viva has only a small influence on the agreed mark awarded to a Part II thesis.

*****These guidelines may change and candidates are notified of any such changes before the end of Hilary Term of their 4th year.

3.4 Scaling

Part II Coursework

Adjustment to marks, known as scaling, normally is not necessary for the Part II theses**.**

3.5 Short-weight convention and departure from rubric

[Not relevant for Part II coursework]

3.6 Late- or non-submission of elements of coursework

Including action to be taken if submission has been or will be affected by illness or other urgent cause, and circumstances in which academic penalties may be applied.

The Examination Regulations prescribe a specific date and time for submission of the required coursework to the Examiners (A Part II Thesis). The normal Rules governing late submission of this coursework and any consequent penalties are set out in the 'Late submission and non-submission of a thesis or other written exercise' clause of the 'Regulations for the Conduct of University Examinations' section of the Examination Regulations (Part 14, 'Late Submission, Non-submission, Non-appearance and Withdrawal from Examinations' in the 2019/20 Regulations). A candidate who fails to submit an element of coursework by a prescribed date and time will be notified of this by means of an email sent on behalf of the Chair of Examiners.

Under the provisions permitted by the regulation, late submission of an element of coursework, as defined above, for Materials Science examinations will normally result in one of the following:

(d) Under paras 14.4 to 14.8. In a case where illness or other urgent cause has prevented or will prevent a candidate from submitting an element of coursework at the prescribed date, time and place the candidate may, **through their college**, request the Proctors to accept an application to this effect. In such circumstances the candidate is **strongly** advised to (i) carefully read paras 14.4 to 14.8 of the aforesaid Part 14, where the mandatory contents of such an application to the Proctors are outlined and the several possible actions open to the Proctors are set out, and (ii) both seek the guidance of their college Senior Tutor and inform at least one of their college Materials Tutorial Fellows. Some, but not all, of the actions open to the Proctors may result in the work being assessed as though it had been submitted on time (and hence with no late submission penalty applied).

(e) Under para 14.9. In the case of submission on or after the prescribed date for the submission and within 14 calendar days of notification of non-submission and without prior permission from the Proctors: subject to leave from the Proctors to impose an academic penalty, for the first day or part of the first day that the work is late a penalty of a reduction in the mark for the coursework in question of up to 10% of the maximum mark available for the piece of work and for each subsequent day or part of a day that the work is late a further penalty of up to 5% of the maximum mark available for the piece of work; the exact penalty to be set by the Examiners with due consideration given to the circumstances as advised by the Proctors. The reduction may not take the mark below 40%.

(f) Under Para 14.4(4). In the case of failure to submit within 14 calendar days of the notification of non-submission and without prior permission from the Proctors: a mark of zero shall be recorded for the element of coursework and normally the candidate will have failed Part I or II as appropriate of the Examination as a whole.

If a candidate is unable to submit by the required date and time, and their inability to meet the deadline is due to COVID-19 or a short-term illness or a flare-up of an existing condition that is documented in a Student Support Plan they should follow a self-certification process**.** For those affected directly or indirectly by COVID-19 this will enable an initial self-certification of up to 14 days, whilst for those affected by a short-term illness (e.g. migraine, noro-virus, gastroenteritis, flu, diarrhoea, etc.) or a flare-up of an existing condition that is documented in a Student Support Plan this will enable an initial self-certification of up to 7 days. Candidates will be able to submit a self-certification for the same submission for up to a maximum of 21 days. Candidates will need to complete the self-certification form themselves, the Proctors will then consider the case and inform the student, college and department of the outcome.

If a candidate is unable to submit by the required date and time for any reason other than for acute illness their college may make an application to the Proctors for permission for late submission. An extended deadline may be approved, or late submission excused where there are grounds of 'illness or other urgent cause'. Applications may be made in advance of a deadline, or up to 14 days from when the candidate is notified that they have not submitted. In all cases, the applications will be considered on the basis of the evidence provided to support the additional time sought.

It should be noted that the maximum extension that the examiners can accommodate for a Part II thesis to be examined in the 2019/20 session is 14 days. Any extension awarded for longer shall mean the assessment will be considered by a scheduled examination board in the next academic year.

If the direct or indirect impact of COVID-19 makes it impossible for a candidate to complete their Part II thesis, this being the means by which the Part II project is assessed, the candidate would be entitled to apply to graduate with a 'Declared to Deserve Honours' (DDH) status by completing an application form at least two days before the deadline for submission of the Part II thesis. It is strongly advised that this option is discussed with college Materials Tutorial Fellows before submitting such an application.

3.7 Penalties for over-length work and departure from approved titles or subject-matter

For elements of coursework with a defined word limit: if a candidate exceeds this word limit without permission normally the examiners will apply a penalty of 10% of the maximum mark available for the piece of work. [It is only possible to apply for permission to exceed a word limit if the Examination Regulations for the specific element of coursework concerned state explicitly that such an application is permitted, excepting that the Proctors may, exceptionally, under their general authority grant such permission.]

3.8 Penalties for poor academic practice

Substantial guidance is available to candidates on what constitutes plagiarism and how to avoid committing plagiarism (see Appendix B of the 2018/19 FHS Course Handbook and https://www.ox.ac.uk/students/academic/guidance/skills/plagiarism?wssl=1)

If plagiarism is suspected, the evidence will be considered by the Chair of the Examiners (or a deputy). He or she will make one of three decisions (http://www.admin.ox.ac.uk/media/global/wwwadminoxacuk/localsites/educationcommittee/documents/policyguidance/Plagiarism_procedures_guidance.pdf):

(d) No evidence, or insufficient evidence, of plagiarism – no case to answer.

(e) Evidence suggestive of more than a limited amount of low-level plagiarism – referred to the Proctors for investigation and possible disciplinary action.

(f) Evidence proving beyond reasonable doubt that a limited amount of low-level plagiarism has taken place – in this case the Board of Examiners will consider the case and if they endorse the Chair's judgement that a limited amount of low-level plagiarism has taken place will select one of two actions:

(iii) Impose a penalty of 10% of the maximum mark available for the piece of work in question and a warning letter to be issued to the candidate explaining the offence and that the present incident will be taken into account should there be a further incidence of plagiarism. For a student who remains on course in addition there will be a requirement to demonstrate to their college Materials Tutorial Fellow that in the period between the present offence and the next submission of work for summative assessment they have followed to completion the University's on-line course on plagiarism (https://www.ox.ac.uk/students/academic/guidance/skills/plagiarism?wssl=1).

(iv) No penalty, but a warning letter to be issued to the candidate explaining the offence, indicating that on this occasion it has been treated as a formative learning experience, and that the present incident will be taken into account should there be a further incidence of plagiarism. For a student who remains on course in addition there will be a requirement to demonstrate to their college Materials Tutorial Fellow

that in the period between the present offence and the next submission of work for summative assessment they have followed to completion the University's on-line course on plagiarism (https://www.ox.ac.uk/students/academic/guidance/skills/plagiarism?wssl=1).

3.9 Penalties for non-attendance

Unless the Proctors have accepted a submission requesting absence from an examination, as detailed in Section 14 of the Regulations, failure to attend the *viva voce* examination in Part II will result in the failure of the whole Part.

4. PROGRESSION RULES AND CLASSIFICATION CONVENTIONS

4.1 Qualitative descriptors of classes (FHS)

The following boundaries (CVCP) and descriptors (MPLSD) are used as guidelines:

Class I Honours 70 – 100	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.
Class II(i) Honours 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.
Class II(ii) Honours 50 – 59	The candidate shows basic problem-solving skills and adequate knowledge of most of the material.
Class III Honours 40 - 49	The candidate shows reasonable understanding of at least part of the basic material and some problem solving skills. Although there may be a few good answers, the majority of answers will contain errors in calculations and/or show incomplete understanding of the topics.
Pass 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 answers, but there will be indications of some competence.
Fail 0 - 29	The candidate shows inadequate grasp of the basic material. The work is likely to show major misunderstanding and confusion, and/or inaccurate calculations; the answers to most of the questions attempted are likely to be fragmentary only.

In reaching their decisions the examiners are not permitted to refer to a candidate's outcome in, or profile across the assessments in, the First Public Examination ('Prelims').

In borderline cases the examiners use their discretion and consider the quality of the work the candidate has presented for examination over the whole profile of FHS assessments; thus for Part I outcomes the Part I assessments, and for overall degree outcomes the assessments for both Parts I and II. The external examiners often play a key role in such cases.

4.2 Classification rules (FHS)

Part II:

Classified Honours –

The following 'safety net' will be applied in respect of the possible impact(s) of COVID-19 on the Part II project and thesis.

Provided a mark of at least 40% is achieved for the Part II project, the overall degree classification for a 2020 final year student reading for the degree of M.Eng in Materials Science will be the higher of:

a) The degree classification based on all assessments (Part I and Part II), using the normal weightings of the Part I & Part II contributions, and as usual taking careful account of all mitigating circumstances, or

b) The degree classification based on only the banked overall Part I FHS mark, taking careful account of any mitigating circumstances that were submitted in respect of the assessments that contributed to that Part I mark.

It is recognised that it is not uncommon for some Materials undergraduates to obtain a better % mark for their Part II project than the overall % mark they achieved at Part I, and in some cases this improvement is sufficient to take a candidate's overall degree mark into a higher classification band than that in which their overall Part I mark sits. Clearly the 'Type 1 Safety Net Policy' does not deal with a case where in the absence of impact(s) of COVID-19 a candidate's Part II mark would have been sufficient to raise their degree classification from that based on their Part I mark alone, but due to these COVID-19 impacts the 'raw' Part II project mark is lower than it otherwise could have been to an extent that the overall degree mark is no longer high enough to raise the degree class in the aforementioned way.

The examiners will address this by careful and sympathetic consideration of all available evidence in respect of mitigating circumstances connected with the potential impact(s) of COVID-19 on each candidate's Part II project mark.

Subject to the requirement that a candidate's Part II mark is at least 40% classification is based solely on the overall percentage mark; the candidate's profile of marks from each element of assessment is only taken into account in borderline cases.

Pass – Notwithstanding the award of unclassified honours in Part I, the examiners consider that the candidate's overall performance is not worthy of an M.Eng. The candidate is listed as a Pass on the class list and is awarded an unclassified B.A. (Hons) on the basis of Part I performance.

Fail – The examiners consider that the candidate's overall performance is not worthy of an M.Eng. *and* that the performance in Part II is not worthy of a Pass. The candidate is excluded from the class list but is nevertheless awarded an unclassified B.A. (Hons) on the basis of Part I performance.

- The examiners cannot award unclassified honours on the basis of Part II performance unless permitted to do so by the Proctors.
- Nevertheless, candidates awarded a Pass or a Fail by the Part II examiners leave with an unclassified B.A. (Hons) because they were judged worthy of that in Part I (i.e. their degree is the same as if they had left immediately after Part I).
- In terms of the degree awarded, there is no difference between a Pass and a Fail in Part II. The only difference is whether or not the name appears on the class list.
- Candidates cannot normally retake Part II because the Examination Regulations require that they must pass Part II within one year of passing Part I. This rule can be waived only in exceptional circumstances, with permission from the Education Committee.

4.3 Progression rules

[Not relevant to Part II]

4.4 Use of vivas

In Part II, a *viva voce* examination is held for all candidates and in 2020 will be held using video-conferencing technology. The effectiveness of the video-conference provision will be tested in advance with each candidate and where this is judged to be inadequate the viva will be conducted by telephone conference call instead. In all cases provision will be in place to switch to a telephone conference call if on the day the video-conference technology/connectivity causes problems.

The purpose of the viva is to clarify any points the readers believe should be explored, and to ascertain the extent to which the work reported is the candidate's.

It is stressed that it is the scientific content of the project and the candidate's understanding of their work that is being considered in the viva.

5. RESITS

Part II may be entered on one occasion only.

6. CONSIDERATION OF MITIGATING CIRCUMSTANCES

[For **late- or non-submission** of elements of coursework, including cases due to illness or other urgent cause, see section 3.6 of the present Conventions.]

There are two applicable sections of the University's *Examination Regulations*.

• **Part 13 Mitigating Circumstances: Notices to Examiners** relates to unforeseen circumstances which may have an impact on a candidate's performance.
• **Part 12 Candidates with Special Examination Needs** relates to students with some form of disability.

Whether under Part 12 or Part 13, a Self-assessment Mitigating Circumstances Form should be submitted directly by the candidate to the Proctors within 5 working days of their last examination. For the purposes of the Part II thesis the day of the last examination shall be taken to be the day on which the thesis is submitted; if a candidate subsequently wishes to draw to the attention of the Examiners mitigating circumstances in respect of their viva the Chairman of FHS Examiners will accept a 'viva-addendum' to the self-assessment form. The viva-addendum should be submitted, normally no later than twenty-four hours after the end of the viva, for the attention of the Chairman of the Materials FHS Examiners by means of an email to undergraduate.studies@materials.ox.ac.uk. The Self-Assessment form and further guidance can be found here: http://www.ox.ac.uk/students/coronavirus-advice/mitigating-circumstances

A candidate's final outcome will first be considered using the classification rules/final outcome rules as described above in section 4. The exam board will then consider any further information they have on individual circumstances.

Where a candidate or candidates have made a submission, under Part 13 of the Regulations for Conduct of University Examinations, that unforeseen factors may have had an impact on their performance in an examination, the final board of examiners will decide whether and how to adjust a candidate's results.

Further information on the procedure is provided in the *Examination and Assessment Framework, Annex E* and information for students is provided at www.ox.ac.uk/students/academic/exams/guidance.

7. DETAILS OF EXAMINERS AND RULES ON COMMUNICATING WITH EXAMINERS

The Materials Science Examiners in Trinity 2020 are: Prof. Hazel Assender, Prof. Simon Benjamin (Chair), Prof. James Marrow, Prof. Pete Nellist, Prof. Roger Reed and Prof. Richard Todd. The external examiners are Prof. Alison Davenport, University of Birmingham, and Prof. Peter Haynes, Imperial College, London.

It must be stressed that to preserve the independence of the examiners, candidates are not allowed to make contact directly about matters relating to the content or marking of papers. Any communication must be via the candidate's college, who will, if the matter is deemed of importance, contact the Proctors. The Proctors in turn communicate with the Chairman of Examiners.

Candidates should not under any circumstances seek to make contact with individual internal or external examiners.

ANNEX

Summary of maximum marks available to be awarded for different components of the MS Final Examination in 2020 (For Part II students who embarked on the FHS in 2017/18)

	Component	Mark
Part I	General Paper 1	100
	General Paper 2	100
	General Paper 3	100
	General Paper 4	100
	Materials Options Paper 1	100
	Materials Options Paper 2	100
	Practicals	60
	Industrial visits	20
	Engineering and Society coursework	20
	Team Design Project	50
	Characterisation or Modelling module	50
Part I Total		*800*
Part II	Thesis	400
Overall Total		*1200*

8. APPENDIX – B.A. IN MATERIALS SCIENCE (EXIT AWARD ONLY)

[Not relevant for Part II]

Reports from the External Examiners for Materials

External examiner name:	Professor Alison Davenport	
External examiner home institution:	University of Birmingham	
Course(s) examined:	Materials	
Level: (please *delete as appropriate*)	Undergraduate	

Please complete both Parts A and B.

Part A

	*Please (✓) as applicable**	**Yes**	**No**	**N/A / Other**
A1.	Are the academic standards and the achievements of students comparable with those in other UK higher education institutions of which you have experience?	✓		
A2.	Do the threshold standards for the programme appropriately reflect the frameworks for higher education qualifications and any applicable subject benchmark statement? *[Please refer to paragraph 6 of the Guidelines for External Examiner Reports].*	✓		
A3.	Does the assessment process measure student achievement rigorously and fairly against the intended outcomes of the programme(s)?	✓		
A4.	Is the assessment process conducted in line with the University's policies and regulations?	✓		
A5.	Did you receive sufficient information and evidence in a timely manner to be able to carry out the role of External Examiner effectively?	✓		
A6.	Did you receive a written response to your previous report?	✓		
A7.	Are you satisfied that comments in your previous report have been properly considered, and where applicable, acted upon?	✓		

* ***If you answer "No" to any question, you should provide further comments when you complete Part B.*** *Further comments may also be given in Part B, if desired, if you answer "Yes" or "N/A / Other".*

Part B
B1. Academic standards

a. *How do academic standards achieved by the students compare with those achieved by students at other higher education institutions of which you have experience?*

The academic standards achieved by the students compare very well with those of other Universities. This was clear both from their performance in examinations and also in project vivas.

The academic standards are consistent with those indicated in the Frameworks for Higher Education Qualifications and the subject benchmarks.

The Department's response to the impact of COVID-19 was very effective and thorough, and gave students the opportunity to attain marks that reflected their capabilities.

The online examination process introduced in response to the pandemic was very well thought-through and appropriate, and there were no indications of any problems that may have disadvantaged individual students.

A detailed assessment of the marks of different papers up to and including the current year showed that the average marks for papers were consistent with, or in some cases somewhat higher than those of previous years, and overall, there was no indication of students being disadvantaged as a result of the pandemic.

The External Examiners were given the opportunity to examine the suitability of examination questions for open book examinations. The Examiners noted that some questions would benefit from modifications to decrease the fraction of questions that could be answered relatively simply with reference to lecture notes. While changes were made for many questions, they were not universal, and this may have contributed to the small increase in average marks for some papers.
This was particularly disappointing following the response to my comments last year: *"The attention of the Chair of Examiners for 2019/20 has been drawn to the need for all examiners and question setters to (i) adhere to the Department's requirement that specimen answers for exam questions should indicate which parts are bookwork and which go beyond this and (ii) note the expectation that an exam question should include some content which enables differentiation within the first-class band of marks."* I hope that this will be more rigorously enforced in the future.

The impact of COVID-19 on Part II projects was managed with great care by the Department. The assessment process took full account of the problems that students faced, including difficulties in obtaining experimental results. Conducting the vivas on Teams worked effectively, and did not appear to cause any significant difficulties for individual candidates.

b. *Please comment on student performance and achievement across the relevant programmes or parts of programmes and with reference to academic standards and student performance of other higher education institutions of which you have experience (those examining in joint schools are particularly asked to comment on their subject in relation to the whole award).*

   The performance of both the Part I Examinations and Part II Theses compared very well with students in this discipline in other Universities.

B2. Rigour and conduct of the assessment process

Please comment on the rigour and conduct of the assessment process, including whether it ensures equity of treatment for students, and whether it has been conducted fairly and within the University's regulations and guidance.

The assessment process was conducted in line with the University's policies and regulations. The Department interacted very effectively and efficiently with the External Examiners, and I was given the opportunity to provide comments as appropriate.

B3. Issues

Are there any issues which you feel should be brought to the attention of supervising committees in the faculty/department, division or wider University?

I was very surprised to see that one student had been granted extensions from the normal time of 4 hours to 24 hours for a series of online examinations. The extensions were granted by the University without any consultation with the Department/examiners to evaluate the suitability of the measure. It was indicated that the extension was intended to permit the student to take suitable rest breaks. However, one might imagine that this measure may encourage candidates to focus on the work over a very long time-period that in a way that could be detrimental to their wellbeing, particularly for a series of papers. Furthermore, an extension of this magnitude does not seem to be appropriate given the nature of the questions in STEM disciplines.

B4. Good practice and enhancement opportunities

Please comment/provide recommendations on any ***good practice and innovation relating to learning, teaching and assessment****, and any* ***opportunities to enhance the quality of the learning opportunities*** *provided to students that should be noted and disseminated more widely as appropriate.*

Part II projects were handled well by the Department this year, despite the difficulties introduced by COVID-19, and the marking and viva process was conducted fairly. However, I noticed this year that five of the six female students were awarded marks in a very narrow band in the low first class range, whereas the male students were awarded marks that ranged much more widely including a number with substantially higher marks. This may well be a statistical anomaly owing to the low number of female students in the year. However, it may provide a valuable opportunity to take a fresh look at the Part II project through the lens of equality and diversity, to see whether the experience of students from all under-represented groups may be affected by a variety of aspects such as their levels of confidence, or potential unconscious bias in the expectations of supervisors. It may also be worth exploring whether the project instructions as discussed with supervisors are clear enough in terms of what is required to obtain exceptionally high marks.

B5. Any other comments

Please provide any other comments you may have about any aspect of the examination process. Please also use this space to address any issues specifically required by any applicable professional body. If your term of office is now concluded, please provide an overview here.

Reflecting on my experience as an Examiner over the last four years, I can say that overall I have been very impressed by the quality of the programme and the assessment processes, and the standards achieved by the students in the Department of Materials.

The examination processes have been fair and transparent, with the internal examiners taking particular care to take into account the circumstances of students throughout. This has been particularly true in 2020 as a consequence of the pandemic, and I commend the very considerable efforts of the Department in the way that they have responded to this major challenge.

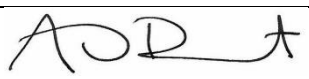
The very thorough and intensive nature of the assessment carried out means that the workload on internal examiners is high, and the learning curve is steep for new examiners. It may be worth considering having greater continuity of examiners between years to ensure that best practice is more easily sustained year on year.

As noted above, I have had ongoing concerns about the variation in the quality of exam questions with respect to the quantity of "bookwork", and the non-uniform use of narratives to show the development of increasing challenge to the students in questions. This has been particularly conspicuous this year as a result of the need for online examinations. Improving adherence to the guidelines, in addition to providing a complete set of detailed responses external examiners in response to points raised would help to generate further improvements to the consistency across the board.

I have throughout my time as an Examiner felt that there are opportunities for improving the quality of the presentation of the Part II reports, and I note responses from the Department of changes that are underway. I hope that improvements in training students to conduct and write up their work will continue throughout the taught elements of the degree with a focus on the clarity of presentation and critical evaluation of the significance of data, including errors and uncertainties. It would be very good to see an even better presentation of the excellent research that many students carry out in their final year.

Finally, I would like to express my gratitude to Philippa Moss for her outstanding support during the examination process. Through her efforts, and those of her colleagues, it has been remarkably straightforward for the External Examiners to explore in great detail the overall distribution of marks and then be able to drill down into the level of the marking of individual scripts and pieces of coursework to gain a very thorough insight into all of the processes involved.

Overall, this is an excellent programme which gives students the opportunity to reach high standards of achievement in a very well-supported environment with very fair and transparent processes.

Signed:	
Date:	30/11/20

Please ensure you have completed parts A & B, and email your completed form to: external-examiners@admin.ox.ac.uk and copy it to the applicable divisional contact set out in the guidelines.

EXTERNAL EXAMINER REPORT FORM 2020

External examiner name:	Peter Haynes	
External examiner home institution:	Imperial College London	
Course(s) examined:	Materials Science Part I (coursework) and Part II	
Level: (please *delete as appropriate*)	Undergraduate	~~Postgraduate~~

Please complete both Parts A and B.

Part A

	*Please (✓) as applicable**	**Yes**	**No**	**N/A / Other**
A1.	Are the academic standards and the achievements of students comparable with those in other UK higher education institutions of which you have experience?	✓		
A2.	Do the threshold standards for the programme appropriately reflect the frameworks for higher education qualifications and any applicable subject benchmark statement? *[Please refer to paragraph 6 of the Guidelines for External Examiner Reports].*	✓		
A3.	Does the assessment process measure student achievement rigorously and fairly against the intended outcomes of the programme(s)?	✓		
A4.	Is the assessment process conducted in line with the University's policies and regulations?	✓		
A5.	Did you receive sufficient information and evidence in a timely manner to be able to carry out the role of External Examiner effectively?	✓		
A6.	Did you receive a written response to your previous report?	✓		
A7.	Are you satisfied that comments in your previous report have been properly considered, and where applicable, acted upon?	✓		

**** If you answer "No" to any question, you should provide further comments when you complete Part B.*** *Further comments may also be given in Part B, if desired, if you answer "Yes" or "N/A / Other".*

Part B

B1. Academic standards

a. *How do academic standards achieved by the students compare with those achieved by students at other higher education institutions of which you have experience?*

The academic standards achieved overall by Part II students in their research projects are highly impressive and compare favourably with other institutions. In terms of student outcomes, the number of graduating students in each class is appropriate when compared with other leading institutions in the UK.

Due to COVID-19 the Part I examinations have been postponed to the autumn but I was able to review some of the Part I coursework. In particular I read some of the reports from the materials modelling module that is taken by the majority of students: expectations are high and while the marking was fair it appeared to me to be quite tough, so I have confidence that high standards are being upheld.

b. *Please comment on student performance and achievement across the relevant programmes or parts of programmes and with reference to academic standards and student performance of other higher education institutions of which you have experience (those examining in joint schools are particularly asked to comment on their subject in relation to the whole award).*

The performance of students in their Part II projects is impressive, even though COVID-19 curtailed the experimental work of the majority. Some of the strongest projects produced research of publishable quality, and I will comment further on that in section B4. I was slightly surprised by the apparently low level of confidence demonstrated by some students in their project *viva voce* examinations, at least compared with students at my own institution who also had to deliver presentations remotely following lockdown. This was most evident when students were asked to give a three minute summary of their project, and it prompted me to wonder how much experience students gain in delivering presentations or participating in interviews during the programme – again I will comment further in section B4.

As mentioned above, the performance of students in the Part I materials modelling coursework compares favourably with the similar module at my own institution. The three methods selected give a good overview of popular contemporary atomistic modelling techniques. The course is extremely well organised with detailed scripts for students to follow and then they select two of these mini-projects to write up for assessment. The overall level of achievement in this module is high.

B2. Rigour and conduct of the assessment process

Please comment on the rigour and conduct of the assessment process, including whether it ensures equity of treatment for students, and whether it has been conducted fairly and within the University's regulations and guidance.

The examiners maintained high standards in the preparation of the Part I papers, which were clearly presented with only occasional errors. The timescale for reviewing the papers was extended this year, which I believe has been beneficial. The nature and content of the questions are appropriate for the subject matter. By the time that they were shared with me it was expected that they would need to be open-book examinations due to COVID-19, and I was impressed by the Department's handling of this: potential changes to each question had been considered in the light of this situation and a summary drawn up for each paper. My understanding is that candidates will be subject to significant time pressure when sitting these examinations, and from my experience of running timed remote assessments at my own institution this summer, I expect the process to be robust with changes only required for a small minority of the questions.

The Department has created a careful plan to enable lecturers to engage with the marking of examination questions. This will be beneficial in enabling lecturers to see how individual students have fared in answering questions on the material they have taught, and it will complement the

statistics and commentary that they already receive and which is in line with good practice elsewhere. In view of the necessary technological changes required, the Department is wise to proceed slowly and with caution.

The online Part II project *viva voce* examinations were extremely well organised and I was thoroughly satisfied by the process. In particular the examiners are required to provide detailed written commentary on a large number of aspects of the report. In all cases the examiners had clearly read the dissertations in detail and identified appropriate lines of questioning. Running two parallel sessions with the two external examiners and a rotating panel membership worked well. Although the mark scheme is the same as last year, I had very few concerns about the moderation across projects this year.

Mitigating circumstances were handled anonymously and in accordance with the University's regulations and I was satisfied that the decisions taken were both fair and compassionate.

B3. Issues

Are there any issues which you feel should be brought to the attention of supervising committees in the faculty/department, division or wider University?

There were a few cases of students missing multiple coursework deadlines and then needing special consideration in order to progress. It seems to me that students with a tendency to procrastinate are not helped by a system where penalties gradually accumulate over time, and that in fact a stricter policy (such as operates at my own institution) would be a more effective deterrent and might end up being of benefit to students. Monitoring of these cases appears to be effective within the Department, and while communication with College tutors is strong, the division of responsibilities across the two does not make timely action easier.

The Department has responded appropriately to the instance of plagiarism in a Part II project last year by introducing the requirement for Part II students to take the University's online course. The Department is considering introducing this for first year students, and I would encourage them to do this.

B4. Good practice and enhancement opportunities

*Please comment/provide recommendations on any **good practice and innovation relating to learning, teaching and assessment**, and any **opportunities to enhance the quality of the learning opportunities** provided to students that should be noted and disseminated more widely as appropriate.*

The format of the Part II research project dissertations is quite long as it is intended to follow the format of a UK PhD thesis. As noted in section B1b, some of the work is of publishable quality, and therefore it seems a shame that the reports are not closer in format to a regular journal article so that students gain experience in this more common format for scientific dissemination. In particular I noted that many students did not seem to have understood how to write a concise abstract, or to select results and arrange the discussion to provide a coherent narrative. This may also be a consequence of COVID-19, since students may have understandably attempted to compensate for a relative lack of results by included absolutely everything they had to hand in their reports. I was pleased to learn that the Part II handbook now includes stronger guidance on the time expected to spent on writing the dissertation, and there was more evidence that students had spent time considering their results this year (although this was also forced upon many of them by COVID-19). As part of its ongoing course review I would encourage the Department to consider requiring a format for the dissertation that is closer to a journal article, while allowing supplementary information that enables examiners to probe points of detail.

This year a couple of students had undertaken projects involving machine learning, which is a rapidly growing area of research that is being adopted within materials science. It is also an area of employment that is highly sought after, so might be a popular option course if the Department were able to develop one.

As mentioned in section B1, I spent some time reviewing the Part I materials modelling coursework this year. Overall I was very impressed but have a couple of minor comments to make. First, the understanding of the relevant theory underlying the modelling techniques was perhaps weaker than I would have expected, although this may simply be the result of a deliberate decision to focus on more practical aspects in the course, which is a perfectly reasonable choice. Second, the short section on multiscale modelling appeared to generate rote answers from lecture notes and rarely seemed to elicit any significant understanding of the ways in which information can be transferred between models at different length- or time-scales. While an understanding of that context is very welcome, that particular requirement of the report might be worth reviewing.

I understand that the Department is considering using *viva voce* examinations to assess the Part I options. In light of my comments about *viva voce* performance in section B1b, I encourage further consideration of this as part of the course review. I have used this approach to examine optional courses in a taught postgraduate programme and found that if students are given a limited period of advance preparation, then this approach is better able to differentiate between high-performing students, as the questioning can probe more deeply than a written examination.

B5. Any other comments

Please provide any other comments you may have about any aspect of the examination process. Please also use this space to address any issues specifically required by any applicable professional body. If your term of office is now concluded, please provide an overview here.

An opportunity to meet a representative group of students over lunch before the Board meetings would be welcome, enabling the external examiners to hear the students' comments and feedback on the programme and their experience.

I understand that there is a suggestion under discussion to rotate the demanding role of Chair of Examiners every five years rather than annually as at present. While this is a very significant job that would require dedication and appropriate recognition, I can identify significant advantages in terms of efficiency, continuity, innovation and the implementation of good practice.

Overall I was again impressed by the programme provided by the Department and the skills and attitudes of the students it graduates. It is also clear that there is a good relationship between staff and students. I am grateful to Ms Philippa Moss and Professor Simon Benjamin for their efficient administration and effective oversight of the entire process that ensure I was able to make effective use of my time and always had the relevant information to hand.

Signed:	Peter Haynes
Date:	18 July 2020

Please ensure you have completed parts A & B, and email your completed form to: external-examiners@admin.ox.ac.uk and copy it to the applicable divisional contact set out in the guidelines.

EXTERNAL EXAMINER REPORT FORM 2020

External examiner name:	Peter Haynes	
External examiner home institution:	Imperial College London	
Course(s) examined:	Materials Science Part I (written exam papers)	
Level: (please *delete as appropriate*)	Undergraduate	~~Postgraduate~~

Please complete both Parts A and B.

Part A				
	*Please (✓) as applicable**	**Yes**	**No**	**N/A / Other**
A1.	Are the academic standards and the achievements of students comparable with those in other UK higher education institutions of which you have experience?	✓		
A2.	Do the threshold standards for the programme appropriately reflect the frameworks for higher education qualifications and any applicable subject benchmark statement? *[Please refer to paragraph 6 of the Guidelines for External Examiner Reports].*	✓		
A3.	Does the assessment process measure student achievement rigorously and fairly against the intended outcomes of the programme(s)?	✓		
A4.	Is the assessment process conducted in line with the University's policies and regulations?	✓		
A5.	Did you receive sufficient information and evidence in a timely manner to be able to carry out the role of External Examiner effectively?	✓		
A6.	Did you receive a written response to your previous report?	✓		
A7.	Are you satisfied that comments in your previous report have been properly considered, and where applicable, acted upon?	✓		

** **If you answer "No" to any question, you should provide further comments when you complete Part B.** Further comments may also be given in Part B, if desired, if you answer "Yes" or "N/A / Other".*

Part B

B1. Academic standards

a. *How do academic standards achieved by the students compare with those achieved by students at other higher education institutions of which you have experience?*

b. *Please comment on student performance and achievement across the relevant programmes or parts of programmes and with reference to academic standards and student performance of other higher education institutions of which you have experience (those examining in joint schools are particularly asked to comment on their subject in relation to the whole award).*

The academic standards achieved by Part I students in their written examinations remain impressive as in previous years. Although the proportion in the first class band for Part I has increased this year it is in line with my own institution.

B2. Rigour and conduct of the assessment process

Please comment on the rigour and conduct of the assessment process, including whether it ensures equity of treatment for students, and whether it has been conducted fairly and within the University's regulations and guidance.

The arrangements for conducting online open-book examinations are in line with those that were put in place at my own institution and my knowledge of practice elsewhere in the UK.

The Department had provided an assurance to students that exam papers would not be scaled down due to the revised arrangements put in place due to COVID-19. Elsewhere in the sector the provisions for "safety nets" were more significant, so I have confidence in the rigour of this process. Although the two option papers did see an increase in the median marks, the mean of the paper on which candidates scored more highly only slightly exceeded the 75% mark where scaling would normally be expected. On the other hand, one of the general papers saw a comparable decrease in the median mark, as a result of deliberate action taken by the examiners this year to address recent trends. The other papers did not see significant changes in their average marks. The fact that the mark distribution peaks around the borderline between the first and upper second classes inevitably means that more students were placed in the top classification for Part I as a result of the overall increase, but this significance of this will be reduced in the final classification when combined with the Part II marks.

The examination papers were reviewed around Easter, by which time the possibility that they might be open book was known. The Department provided additional commentary on the suitability of each question under these circumstances and I was encouraged to respond to this as well. With the benefit of hindsight it is clear that it is very difficult to predict the impact of this change in procedure, although it seems clear that the more advanced nature of the material taught in the options is more challenging for this sort of assessment. It appears that questions with several sections may have put candidates under greater time pressure and reduced the benefit of access to notes. More quantitative questions also appear to have been less significantly affected. Significant changes were made to some questions following the move although it should be noted that the marks on some of these questions were still high. Overall the Department responded well to the significant change in approach announced when the setting of questions was almost complete.

The examination papers were prepared to a high standard as usual. In one question there was an error in a formula question that resulted in an implausible solution but I checked carefully and the compensation in the marking was fair and I could identify no candidates who had been disadvantaged. Indeed in some cases this provided students with an opportunity to demonstrate deeper understanding for which they received credit.

B3. Issues

Are there any issues which you feel should be brought to the attention of supervising committees in the faculty/department, division or wider University?

A small number of candidates had one additional hour for each paper to allow for specific learning difficulties. One candidate was allowed 24 hours to complete each paper. Since no details were provided by the College at the time of the Board I cannot comment on the appropriateness of this decision, but it does appear to be a very significant increase in time given the nature of the written papers in the physical sciences and it is far from clear to me that it is in the best interests of the candidate to sit six examinations under these arrangements as they will rightly wish to use as much of that time as possible to refine their answers, with a potential impact on their wellbeing.

One candidate was repeatedly late in submitting their answers and received penalties as a result. It was not clear to me whether they had been contacted after the first occasion to check that they understood the process and the consequences, but it would seem to be good practice for departments and colleges to liaise on this point.

B4. Good practice and enhancement opportunities

*Please comment/provide recommendations on any **good practice and innovation relating to learning, teaching and assessment**, and any **opportunities to enhance the quality of the learning opportunities** provided to students that should be noted and disseminated more widely as appropriate.*

Question setters who provided a narrative about the intent of each section of their question (e.g. recall of knowledge, understanding of concepts, unseen problem solving) were better placed to identify suitable changes to make in the light of the move to open book.

I recommend that the Department reviews those questions, particularly on the option papers, where the average marks were in line with the expected range of 65% and considers these as potential examples of good practice for open book examinations with characteristics that could be implemented more widely.

B5. Any other comments

Please provide any other comments you may have about any aspect of the examination process. Please also use this space to address any issues specifically required by any applicable professional body. If your term of office is now concluded, please provide an overview here.

Overall the Department has coped admirably with the changes to the examination process this year. This is testament to the professional standards of administration and the commitment of the examiners.

Signed:	Peter Haynes
Date:	25 November 2020

Please ensure you have completed parts A & B, and email your completed form to: external-examiners@admin.ox.ac.uk and copy it to the applicable divisional contact set out in the guidelines.

Faculty of Materials

Department of Materials Academic Committee

RESPONSE TO EXAMINERS' REPORTS 2020

Honour School of Materials Science (MS) Parts I & II

The External Examiners' reports, the FHS Chairperson's report and internal reports on all of the individual Materials papers, were considered by the Department of Materials Academic Committee (DMAC) and were provided to the Faculty of Materials.

1. Summary of major points

There were no major issues arising from the 2020 Examinations.

2. Points for inclusion in Responses to the External Examiners

MS Parts I & II: Professor A. Davenport

As in previous years we thank Professor Davenport for her overall very positive report, constructive comments, and the time and effort devoted to her role as an External Examiner, not least in the substantial task of examining the Part II MS theses. We are also grateful for the comments made during the additional review of the examination questions during the transition from closed to open book assessment.

In response to specific comments:

- In the revision from closed book to open book, the examiners paid attention to reduce the fractions of questions that could be answered with simple reference to lecture notes. Each question was reviewed to ensure there was a sufficient balance between recall and demonstration of understanding. The internal examiners will continue to require question setters to indicate which parts of the proposed question are bookwork and which go beyond this and have an expectation that an exam question should include some content which enables differentiation within the first-class band of marks. This is enforced by the Chair of Examiners.
- The student experience at Part II is currently being reviewed by the Department of Materials Equality and Diversity Committee. The findings will be considered by the Department of Materials Academic Committee and adjustments will be made to the guidance provided to supervisors if necessary.
- The importance of presentation and critical evaluation of the significance of data, including errors and uncertainties, is in the current guidance to Part II. The Department expects the Part II thesis, which reports on an eight-month full-time project, to follow the format and expectations of a traditional UK PhD thesis, including critical discussion. During Michaelmas Term 2019 explicit written guidance on this was drafted by the Chair of our teaching committee (DMAC), reviewed by the Committee, and was added to the Part II Handbook, including an indication of what is the typical chapter-by-chapter content of such a thesis. As part of the rolling review of the undergraduate course, we have also introduced a requirement to write up pre-selected practical reports (3 per year) for formative and summative assessment in a journal paper format. The assessment and feedback of this has a specific focus on clarity of presentation and critical evaluation of the

significance of data, including errors and uncertainties. We expect this to aid the Part II students in the presentation of the research work of their Part II thesis. This training was introduced in Year 1 in 2019-20, and in Year 2 in 2020-21, so we have yet to see its impact on Part II.

- The Examiners normally undertake a 3-year stint. This structure, as described in the standing orders[3] has been put in place to balance the load on Faculty members and to have sufficient continuity of approach in best practice. The Faculty of Materials will be consulted on whether to extend these appointments.

MS Parts I & II: Professor P. Haynes

We thank Professor Haynes for his very positive report, his thoughtful and constructive comments, and the time and effort devoted to his role as an External Examiner, not least in the substantial task of examining the Part II MS theses.

In response to specific comments:

- Students have the opportunity to develop experience in oral presentation throughout the course, including in particular the assessed Team Design Projects (Y3 Michaelmas Term), and the formative Part II Presentations (Y4 Trinity Term). The latter, which is intended to give the students experience of presenting and defending their research did not take place in 2020 due to Covid. The event will take place in 2021, as an online session, but it is not compulsory.
- There is a formal requirement for Part II students to complete an online course on the avoidance of plagiarism. Plagiarism is introduced as a topic in Year 1, and students are advised, but not required, to complete the online course on the avoidance of plagiarism. Software detection for plagiarism (Turnitin) is used with all work submitted online, including the Practical Reports. We currently consider that this is sufficient.
- As noted above, the department continues to expect the Part II thesis, which reports on an eight-month full-time project, to follow the format and expectations of a traditional UK PhD thesis. Training in writing of journal papers is now being provided in Year 1 and Year 2.
- Currently, there is no plan to use viva voce for assessment of the Part I options.
- As noted above, the duration of the Chair of Examiners appointment will be discussed by the Faculty of Materials.
- The student who consistently submitted late examination papers was contacted. The reason for this was confirmed to be valid and no penalty was applied.

[3] Standing Orders for Appointments to Boards of Examiners state:
"For individual nominations, subject to the over-riding requirement for the Examination Boards to (a) comprise examiners or moderators with a suitable mix of subject knowledge and (b) to be chaired by a person with suitable prior experience of examining, the Nominating Committee shall make best efforts to (i) nominate to a pattern of three consecutive years as an examiner followed by at least four years free of examining and (ii) to nominate an examiner as chair no sooner than the 10th year after they last served as chair.
Upon adopting the procedures described … the Faculty of Materials agreed that normally its members shall be obliged to serve when nominated as an examiner or chair.
For continuity, where possible the three year nominations will be made such that approximately one-third to one-half of the Examination Board changes each year.
Normally the office of Chair is held for one year, in the second year of the relevant three year period for which the Chair is an examiner. The examiner who held the post of Chair in the previous year acts as Deputy Chair in their third year."

3. Further Points

There are no concerns raised in the detailed reports of the internal examiners for the FHS on which we wish to comment, other than items also raised by one or both external examiners.

The FHS examinations in 2020 were undertaken in circumstances that were a consequence of the Covid-19 pandemic.

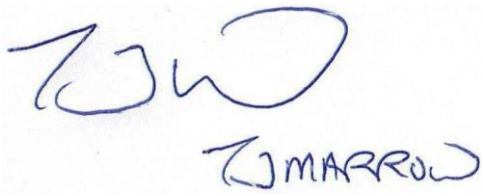
The Part I examinations were postponed from Trinity Term to the following Michaelmas Term, and were conducted remotely as open-book assessments. This accelerated plans that were in place for online marking of examination papers.

The Part II research period was affected by the closure of laboratories at the end of Hilary Term and during Trinity Term, and the oral examinations were conducted online during Trinity Term. These circumstances were accounted for in the examination conventions, which were revised for this purpose.

4. Other matters on which departments are mandated to report to Division

We confirm that the examiners held specific meetings to consider Mitigating Circumstances Notices.

We confirm that qualitative checks were carried out in respect of scaling, as stipulated in Section 3.4 of our FHS Exam Conventions.



T.J. Marrow, Chair of DMAC, 18/03/20