# EXAMINERS' REPORTS 2017 – Redacted Version

## MATERIALS SCIENCE (MS)
## MATERIALS, ECONOMICS & MANAGEMENT (MEM)

# REPORT ON PRELIMINARY EXAMINATION IN MATERIAL SCIENCE

**Part I**

## A. STATISTICS

| Category | Number | | | Percentage | | |
|---|---|---|---|---|---|---|
| | 2016/17 | 2015/16 | 2014/15 | 2016/17 | 2015/16 | 2014/15 |
| Distinction | 12 | 10 | 8 | 33 | 31 | 25 |
| Pass | 22 | 22 | 23 | 61 | 69 | 72 |
| Fail | 2 | - | 1 | 6 | - | 3 |

**Marking of scripts**

Scripts are single marked except for borderline cases which are double-marked.

## B. NEW EXAMINING METHODS AND PROCEDURES

The examination conventions were updated to the new University template and the description of the procedure for double marking of borderline cases was made more explicit. In addition to each moderator having the responsibility for setting and marking their principal paper, they were also assigned a second paper from the outset. The aim was to ensure greater scrutiny of the papers as well as improving familiarity prior to second marking.

Recent examiners' reports have expressed concern over the trend for increasingly high prelims marks which indicate that the exam questions are too predictable. This year it was decided that, in line with standard practice in Part I examinations, it was not necessary to set questions on every 4 lecture course and that questions may require knowledge from more than one lecture course. This was communicated to the students at the end of MT as it was a departure from standard practice over the last 5 years or so. The guidance that is given to lecturers when they are asked to suggest questions was also added to with the following:

- Last year's moderators noted the similarity of questions to previous years; this year please compose questions which are markedly different.
- Please note that the examination conventions state that to achieve a mark of over 70% (14/20 marks): *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.*

## C. Please list any changes in examining methods, procedures and conventions which the examiners would wish the faculty/department and the divisional board to consider.

Materials Papers

The average marks for all three Materials papers are significantly lower than last year, suggesting the efforts made to make these papers less predictable were (at least partially) successful. However the average marks are still considerably higher than for Finals and it is still the case that some questions did not extend the students enough. These more straightforward questions were easily spotted by the candidates and were answered by large proportions of the cohort. In order to make Prelims examinations a more realistic indicator of Finals performance and more useful preparation for the students, it is suggested that:

(a) Every question is very carefully assessed for where it extends the students beyond reproducing arguments given in the lectures or rehearsed in the tutorial questions/past exam papers. If it is not clear from the lecturer's worked solution and commentary which parts of the question fulfil this requirement, the moderator should request this additional information from the lecturer in a timely manner.

(b) Since some lecture courses may not lend themselves to this style of question (particularly the short courses which do not contain very much conceptually challenging content), it is proposed that there is a serious discussion on changing the format of the Materials papers, as has been mentioned in previous examiners' reports. For example a compulsory section could be included to test basic knowledge, followed by a second section (with choice of questions) designed to extend the students and test their problem-solving skills. This would have the additional benefit of discouraging students from avoiding the challenging courses that provide important foundations for the rest of the undergrad course. Alternatively, questions could retain their current format, but the paper could be split into sections with students being required to answer questions from each section.

[redacted]

Maths Paper
The average mark on the Maths paper this year was considerably higher than in previous years (80% compared to 73% in 2016 and 70% in 2015). This was largely a result of the very high marks obtained in the optional Section B questions. It is recommended that the lecturers (and/or tutors) on the Maths course analyse the paper and report on whether they consider the questions to be more straightforward than usual. This should be taken into account when setting the paper next year, as such high average marks on this paper have skewed the overall results considerably.

Crystallography coursework
The coursework paper is made up of 50% from the first year practicals and 50% from the crystallography classes. This year the crystallography class marks were even higher than usual with a very narrow spread (83-98%). It is suggested that the reason for this is investigated thoroughly, as it is a significant contributing factor to the high overall marks.

**D. Please describe how candidates are made aware of the examination conventions to be followed by the examiners**

Circulation by Deputy Administrator (Academic) to all students and tutors by e-mail, hard copy, and onto the Departmental website.

A copy of the conventions for this examination is attached below.

**Part II**

**A. GENERAL COMMENTS ON THE EXAMINATION**

36 students were registered for the examination.

34 candidates passed all papers, without the necessity for compensation. Of these 34 successful candidates in June, 12 were awarded Distinctions, all with marks of 79.2% or more (rounded). 2 candidates failed one paper (both failed MS2) and are required to resit this in September. This year two more distinctions were awarded than in 2016.

The prize for the best overall performance in Prelims was awarded to Benjamin Shi, of Mansfield College. The prize for the best performance in 1st year Practicals was also awarded to Benjamin Shi. Additional prizes for outstanding performance were awarded to Techin Tungcharernpaisarn and Poppy Miller, both of Corpus Christi College.

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

With the approval of the Proctors, 2 candidates were allowed (i) extra time [redacted] or (ii) [redacted]. These allowances seemed satisfactory.

**Gender Issues:**

Of the 36 candidates 7 were women and 29 men.

2 of the 12 distinctions were awarded to a woman.

In view of the small overall number of candidates, it is not sensible to draw conclusions from these data. The mean score for males was 74.8% and for females 71.0%.

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

All candidates took the same papers for the whole examination.

## D. COMMENTS ON PAPERS AND INDIVIDUAL QUESTIONS

Attached.

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

[redacted]

## F. NAMES OF MEMBERS OF THE BOARD OF EXAMINERS

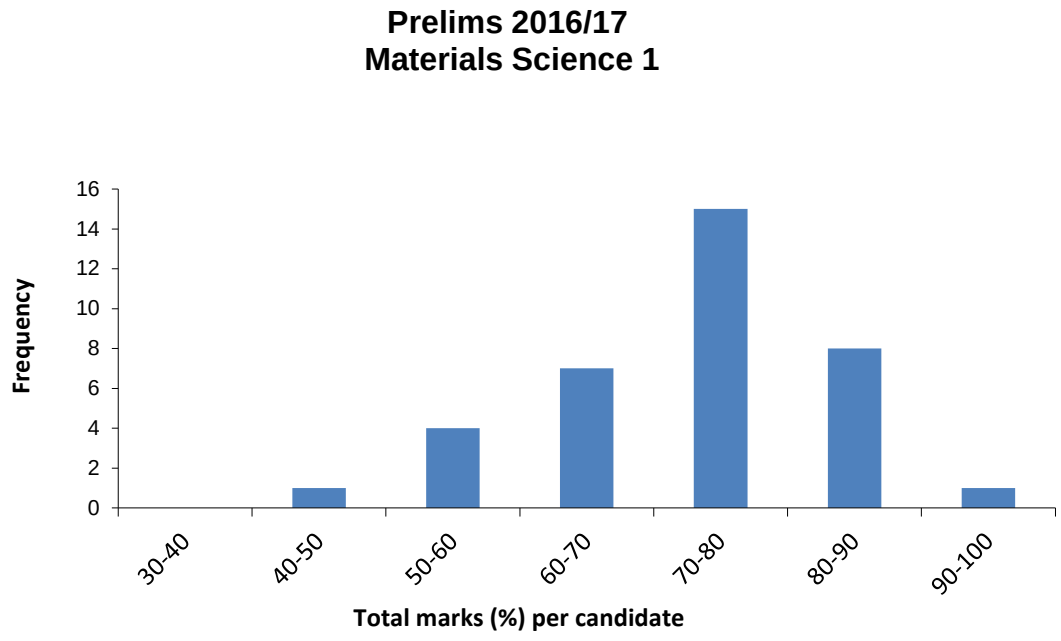
Professor S.C. Speller (Chair)
Professor H. Bhaskaran
Professor K. Porfyrakis
Professor A.A.R. Watt

## MS1 – Structure of Materials

**Examiner:** **Professor Susie Speller**
**Candidates:** **36**
**Mean mark:** **72.86 %**
**Maximum mark:** **92%**
**Minimum mark:** **41%**

Detailed comments on the paper are as follows:

| Question | No of Answers | Average Mark | Highest Mark | Lowest Mark | Topic |
|---|---|---|---|---|---|
| 1 | 31 | 15.77 | 20 | 10 | Ceramics and Semiconductors |
| 2 | 31 | 15.55 | 20 | 10 | Metals and Alloys |
| 3 | 34 | 15.82 | 19 | 12 | Defects in Crystals |
| 4 | 11 | 13.55 | 18 | 10 | Quantum Theory |
| 5 | 5 | 14.20 | 17 | 12 | Polymers and Composites |
| 6 | 21 | 11.48 | 18 | 4 | Crystallography |
| 7 | 23 | 13.00 | 19 | 6 | Diffraction |
| 8 | 24 | 14.75 | 18 | 7 | Waves |



## General comments:

The average overall marks on this paper were relatively high again this year. The paper contained three straightforward questions based on short lecture courses (Q1-3) that required standard bookwork and relatively simple calculations similar to problems encountered previously by the students. These were very popular questions and received high marks. The questions based on the Crystallography and Diffraction lecture course (Q6-8) were also relatively popular, but with significantly lower average marks and a wider range of marks, suggesting that these extended the students further. The Polymers and Composites question (Q5) was very unpopular again this year with only 5 attempts (compared to 6 attempts in 2016), despite requiring only standard bookwork. This strongly suggests that the students are strategically avoiding learning this lecture course.

## Specific Comments:

1) Ceramics and Semiconductors: Good knowledge of bonding types and properties, but some candidates were weaker on explaining the links between bonding and properties. Only a few candidates gave a clear comparison of the differences between the bonding types. The students were generally good at applying their knowledge of the structure of MoS2 to explain its lubricant properties. Most were familiar with Pauling's rule and performed the simple calculation accurately. The final section of the question required the students to apply a method they had practised for calculating minimum cation:anion radius ratio to a different crystal structure. It was generally answered well.

2) Metals and Alloys: Recall of Hume-Rothery rules was good. Students used several slightly different approaches to calculating the density of Rh. Those that used recall of packing fractions of FCC and BCC crystals without giving the derivation did not receive full marks. The experimental observations in part (c) were explained well by most students, with the exception that relatively few mentioned the CuAu superlattice.

3) Defects in Crystals: This very popular question was very straightforward for the students, requiring fairly simple bookwork and easy calculations. Clear and thorough explanations were required to achieve full marks.

4) Quantum Theory: This question tested the students understanding of solutions to Schrodinger's equation and quantum tunnelling. There were very few correct solutions to the final part of the question which was a simple (but unfamiliar) calculation, revealing incomplete understanding and misconceptions in many candidates.

5) Polymers and Composites: A fairly straightforward but unpopular question on the viscoelastic properties of polymers. In general, the links between mechanical behaviour and processes occurring on a molecular scale were not well understood. In particular there was confusion over cross-linking and degree of crystallinity.

6) Crystallography: Recall of the 2D Bravais lattices was rather variable. There were very few complete answers to why the tetragonal F lattice is not included in the 3D Bravais lattices but the cubic F lattice is. Most students could draw the [0001] projection, but the stereographic projection was more problematic. Some students thought that the absolute bond length would influence the radial position of the poles on the stereogram, but many correctly reasoned that it is the c/a ratio that is important.

7) Diffraction: Good answers to the Bragg's law derivation. However, there was fairly widespread misunderstanding about what "n" represents in Bragg's law (with several students seeming to confuse it with the $h^2+k^2+l^2$ value). There was only one reasonable answer to the final part of the question about the conditions for observing the reflection from a single crystalline sample which tested their understanding of diffraction.

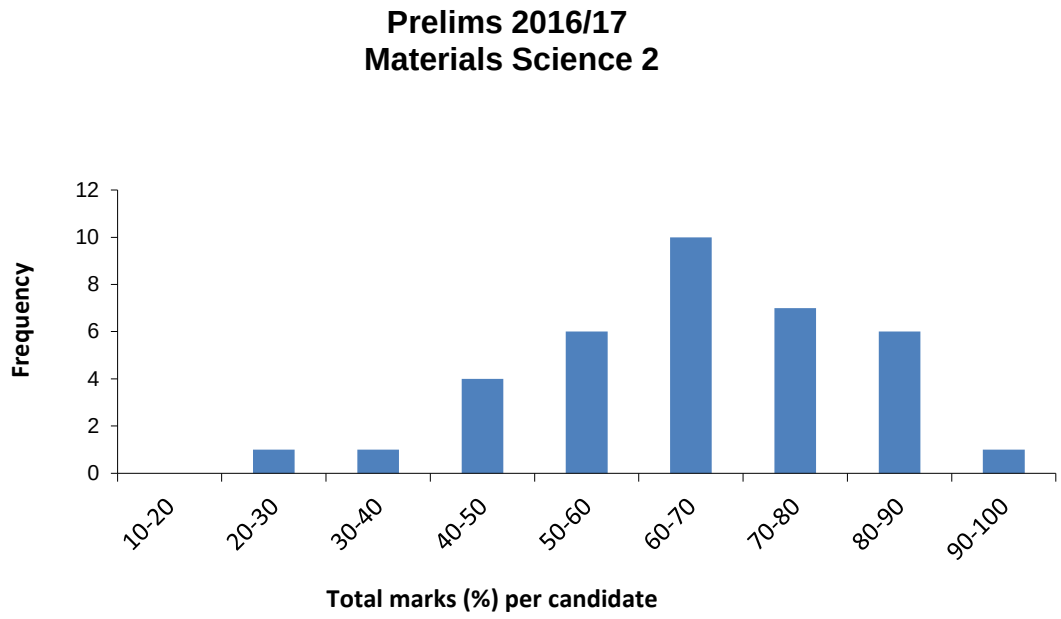
8) Waves: This question combined the superposition of waves (from the Crystallography and Diffraction lecture course) with the idea of a wavefunction in quantum mechanics. In general, most of the candidates understood the form of the wave equation and could do the simple algebraic manipulation required to arrive at the equation for the interference wave. However, explanations of the quantum wavefunction were generally weaker.

## MS2 – Properties of Materials

**Examiner(s):** **Professor Harish Bhaskaran**
**Candidates:** **36**
**Mean mark:** **65.42%**
**Maximum mark:** **91%**
**Minimum mark:** **27%**

Detailed comments on the paper are as follows:

| Question | No of Answers | Average Mark | Highest Mark | Lowest Mark | Topic |
|---|---|---|---|---|---|
| 1 | 27 | 10.89 | 19 | 3 | Mechanical Properties |
| 2 | 36 | 15.08 | 20 | 6 | Mechanical Properties |
| 3 | 23 | 9.41 | 18 | 0 | Elasticity and Structures |
| 4 | 34 | 14.34 | 20 | 0 | Elasticity and Structures |
| 5 | 17 | 11.65 | 19 | 5 | Elasticity and Structures |
| 6 | 9 | 13.44 | 19 | 5 | Electricity and Magnetism |
| 7 | 9 | 11.22 | 18.5 | 5 | Electricity and Magnetism |
| 8 | 25 | 15.76 | 20 | 6 | Kinetic Theory of Gases |



## General comments:

Overall performance on this paper was balanced and allowed for clear differentiation between weak and strong students. Questions on Mechanics were very popular, particularly Question 2, which was attempted by every candidate. However, the overall marks for this question does not suggest it was considerably easier than the others. The highest mark obtained was 91%, but at the other end of the spectrum, two candidates scored less than the pass mark. Overall, candidates preferred descriptive questions and those involving textbook derivations. Overall, not all candidates answered different questions on different booklets, nor were the questions answered clearly numbered on the front sheet of the booklet.

## Specific Comments:

1) This was a question on Diehl's rule. In general, this was a popular question, but the average mean mark was lower than the overall mean of the paper, with a wide range of marks, suggesting that the structure of the question allowed for differentiation between weak and strong students.

2) An extremely popular question attempted by every student, although not the one with the highest mean mark. This question tested conceptual understanding of work hardening, and in general most students displayed a good understanding of the fundamentals.

3) A reasonably popular mechanics question on the calculation of forces and bending moments in a cantilevered structure. Again, the question allowed for proper differentiation between weak and strong students. Understanding of moments was typically weaker than that of forces. Conventions regarding force directions were deemed more important than actually understanding directionality – this seemed to contribute to many of the calculation errors.

4) This was a very popular question on Mohr's circle, attempted by all but 2 candidates. It had an average mark roughly in line with the overall paper, with a wide differentiation of weak and good students.

5) This was a descriptive question on a conceptual understanding of the interaction between atomic forces and mechanical properties of the material. Overall, this was attempted by just under half the candidates.

6) One of two questions on Electricity and Magnetism, and had a similar attempt rate as the other question. Relatively few candidates attempted this question, but those attempting it scored marks similar to the average for the whole paper.

7) Another question on electrostatics, but using a real-life example. Those who scored well in this question had a clear conceptual understanding of this subject. Again a relatively low attempt rate for this question.

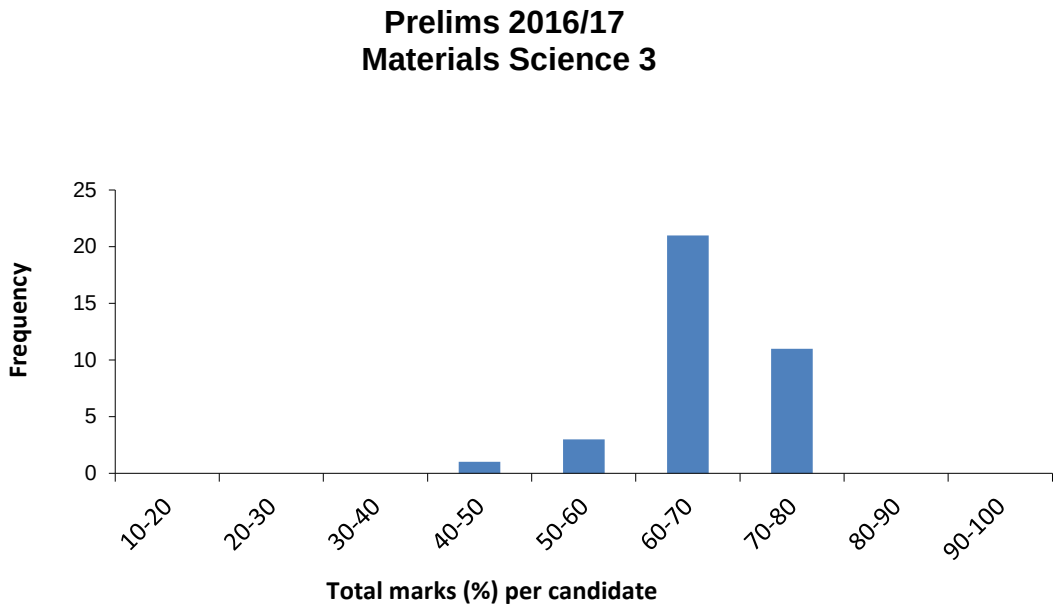
8) A question on the Kinetic Theory of Gases, with roughly 25 of 36 candidates attempting it. The average mark was slightly higher than the average for the paper as a whole, but overall, the question allowed for proper differentiation between weaker and stronger candidates.

## MS3 – Transforming Materials

**Examiner(s):** **Professor Andrew Watt**
**Candidates:** **36**
**Mean mark:** **67.08%**
**Maximum mark:** **80%**
**Minimum mark:** **46%**

Detailed comments on the paper are as follows:

| Question | No of Answers | Average Mark | Highest Mark | Lowest Mark | Topic |
|---|---|---|---|---|---|
| 1 | 17 | 11.15 | 17.5 | 3.5 | Reaction Kinetics |
| 2 | 22 | 13.43 | 18 | 9 | Thermodynamics |
| 3 | 26 | 11.27 | 18 | 3 | Thermodynamics |
| 4 | 29 | 14.03 | 18 | 10 | Polymer Synthesis |
| 5 | 28 | 12.38 | 16 | 8 | Microstructures |
| 6 | 24 | 15.46 | 18 | 10 | Microstructures |
| 7 | 12 | 12.50 | 15 | 5 | Microstructures |
| 8 | 22 | 16.48 | 19 | 15 | Electrochemistry |



## General Comments

Relatively high scoring paper with a narrow band of results around the high 60% mark. All bar one question answered by at least half of the cohort, an improvement on previous years. Some question elicited very similar answers between students, suggesting the questions were too predictable and did not extend the students sufficiently.

## Specific Comments

1) **Reaction Kinetics** question was very predictable and the answers were either excellent or poor. The question was too long and would have benefited from condensation and more developed high scoring parts.

2) **Thermodynamics** question on Ellingham diagrams was again very predictable. In general answers were much better than Q1 and of appropriate length.

3) **Thermodynamics** Boilerplate question on Gibbs free energy. Some students excelled while others struggled.

4) **Polymer Synthesis** question that drew part (d) from the Processing course. This did not faze the students. Unusually for a polymers question, 29 out of 36 students answered the question making it the most popular in the paper. The question was perhaps too easy and could have benefited from more problem solving elements.

5) **Microstructures** question on casting. This was the 2$^{nd}$ most popular question on the paper. The average mark was good, but few high marks were awarded, owing to a lack of detail in the students' answers.

6) **Microstructures** question on iron-based alloys. Very well answered question with every student achieveing 50% or higher.

7) **Microstructures** question on Al-Cu eutectic alloys. Some students struggled with answering this and this question was the least well-answered question in the paper.

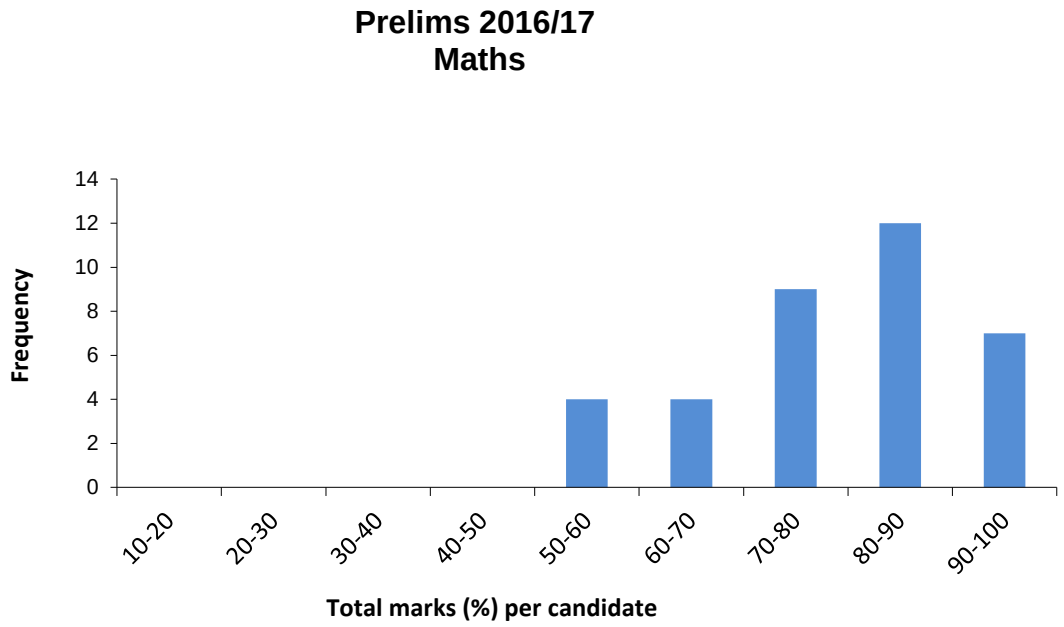
8) **Electrochemistry** question which the students found straightforward, even though some of the necessary reaction potentials were missing from the question and had to be updated during the exam.

## Mathematics for Materials Science

**Examiner(s):** **Professor Kyriakos Porfyrakis**
**Candidates:** **36**
**Mean mark:** **80.31%**
**Maximum mark:** **100%**
**Minimum mark:** **56%**

Detailed comments on the paper are as follows:

| Question | No of Answers | Average Mark | Highest Mark | Lowest Mark |
|---|---|---|---|---|
| 1 | 36 | 6.25 | 8 | 2 |
| 2 | 36 | 5.53 | 8 | 0 |
| 3 | 36 | 5.81 | 8 | 3 |
| 4 | 36 | 5.06 | 8 | 0 |
| 5 | 36 | 6.61 | 8 | 0 |
| 6 | 36 | 7.03 | 8 | 0 |
| 7 | 36 | 4.92 | 8 | 0 |
| 8 | 36 | 6.36 | 8 | 2 |
| 9 | 36 | 6.58 | 8 | 3 |
| 10 | 36 | 7.31 | 8 | 4 |
| 11 | 23 | 21.39 | 25 | 4 |
| 12 | 28 | 20.43 | 25 | 11 |
| 13 | 14 | 20.71 | 25 | 4 |
| 14 | 10 | 11.40 | 23 | 1 |
| 15 | 32 | 21.53 | 25 | 11 |
| 16 | 36 | 22.56 | 25 | 10 |



## General comments:

Very high marks were achieved across the board. The marks are reasonably well distributed but shifted towards higher values, compared to previous years. The maths paper has a unique characteristic compared to the rest of the prelims papers; Section B which includes the optional questions outweighs Section A (compulsory questions) in terms of the total marks value. This year, the students obtained very high marks on the Section B questions, with vectors/matrices questions being the most popular and questions on the HT courses being the least popular. Whilst the maths lecturers and tutors should be congratulated for transferring knowledge to the students, the extremely high marks suggest that some of these Section B questions were well within the students' comfort zone and did not challenge or extend them sufficiently. This should be considered when setting next year's questions.

## Specific Comments:

Section A:

1) Reasonably good attempts at this question on sketching a function.

2) Good answers to this partial differentiation question. Some students struggled to follow the total differential methodology approach to the end.

3) Complex numbers question. Most students struggled with correct plotting of the roots of the complex function.

4) A question that polarised students. Some did it very well to the end, with others failing at an early stage.

5) A well-answered question on binomial theorem expansion. Most students were comfortable with it.

6) A high average mark on this simple calculus question on computing limits.

7) A question on streamlines for fluid flow. Most students struggled with the general integral.

8) A very well-answered question on vectors. Most students were successful in calculating the required distance.

9) Again, a very well done question on lattice vectors and spacing. Students were comfortable with it.

10) A question on matrices and eigenvectors. Most students answered it well.

Section B:

11) A popular question on partial and total derivatives. Students were comfortable with it and high marks were obtained on average.

12) A popular question on pendulum dynamics. It involved a quadratic equation with complex roots. Most students were comfortable with it and obtained high marks.

13) A less popular question involving a Taylor series expansion. Most students who stuck with it produced good answers.

14) The least popular question of all. It involved moments of inertia calculation. Most students struggled with the angular momentum of a spherical shell.

15) A very popular and well-answered question on matrices and vectors.

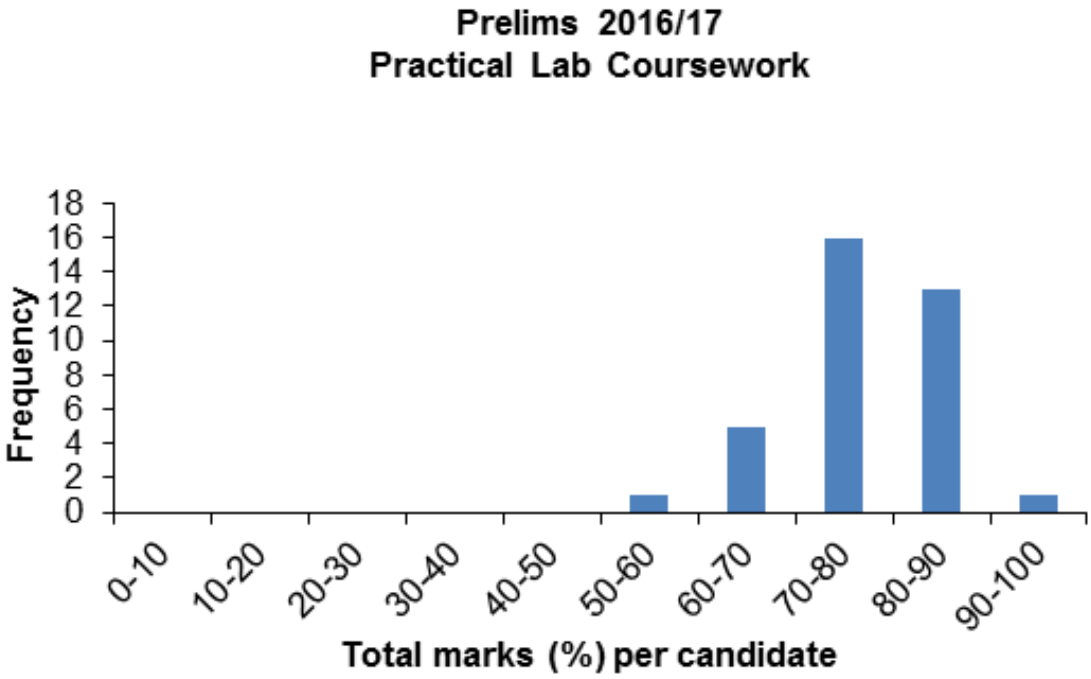
16) The most popular optional question that was attempted by **all** of the students. It involved matrix eigenvalues and eigenvectors. Most students did very well, obtaining the highest average mark of Section B.

## Practical Lab Coursework

**Candidates:** **36**
**Mean mark:** **75.9%**
**Maximum mark:** **90%**
**Minimum mark:** **57%**

Detailed comments on the coursework are as follows:

| Lab No | Average Mark | Highest Mark | Lowest Mark |
|---|---|---|---|
| 1P2 | 6.67 | 9 | 3 |
| 1P3 | 8.71 | 10 | 5 |
| 1P4 | 7.69 | 9 | 6 |
| 1P5 | 7.39 | 9 | 5.5 |
| 1P6 | 6.47 | 9 | 4 |
| 1P7 | 7.22 | 10 | 1 |
| 1P8 | 7.86 | 9.5 | 3.5 |
| 1P9 | 8.31 | 9.5 | 7 |



## Report from the Practical Class Organiser for 1st year Practicals 2016-17

I have reviewed the marks from the 1st year Practicals 2016-17. There is quite a broad range of overall average marks ranging from 57.0 to 89.4%. The range of marks for an individual practical vary from practical to practical, with 1P7 having a particularly wide range of marks and 1P3 and 1P4 having the narrowest ranges. All candidates carried out all practicals so I believe that all students have been treated equally and I am not recommending that the marks are modified to account for these differences.

**Gender:** I have assessed the marks for gender imbalance by looking to see who has received the highest and lowest marks for each practical and have not found any evidence of bias.

**Penalties:** I have looked at the suggested penalties and am recommending that these are accepted in their entirety. I would however like to bring to the attention of the Moderators that one individual incurred a total of 7 penalty marks for late submission, which may be indicative of taking a "calculated gamble" that the extra time to improve or complete the write-up would improve their mark sufficiently to more than compensate for the penalty incurred. I also note that all of the penalties incurred were by candidates from the same college.

**Problems which occurred in the labs during the course of the year which the Moderators should be aware of as potentially affecting candidates' marks:** there was a safety-related issue with 1P6 Thermal Analysis which lead to the evacuation of half of the year group from the labs for a short period of time. All students were able to complete the practical in the time, and where data was missing as a result of the incident, pre-collected data was issued to the students to allow them to complete their write-ups. The Senior Demonstrator was present at the time of the incident and did not believe that the incident affected the candidates' ability to complete and write-up the practical. I do not therefore recommend any modification to the marks for this practical.

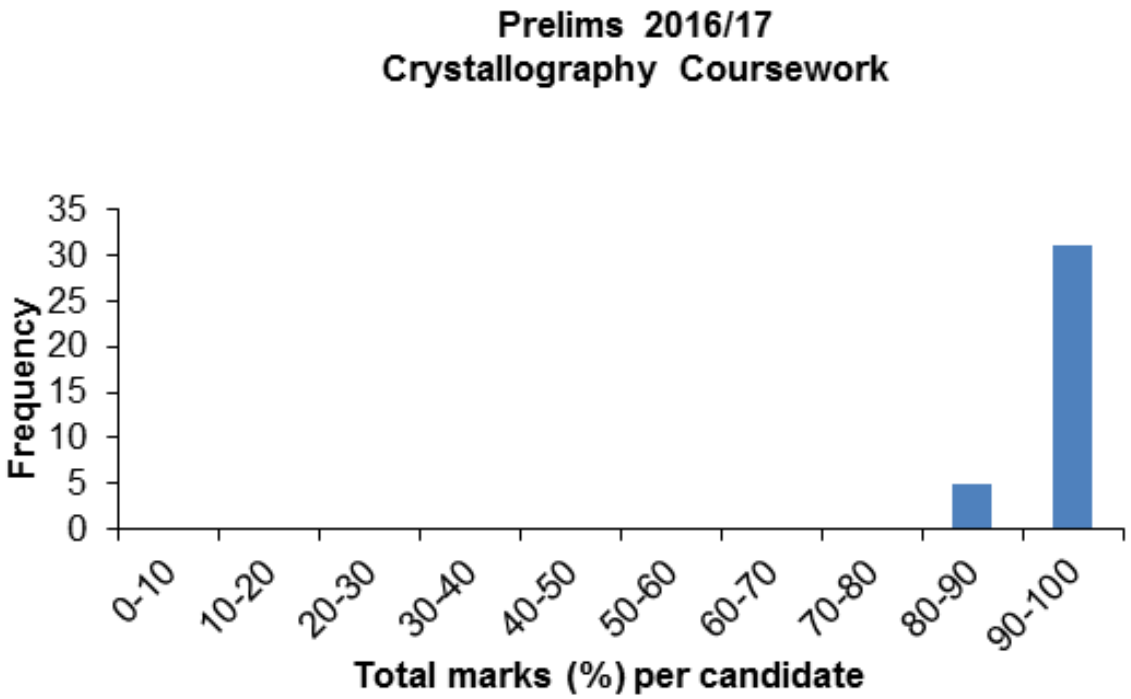
Keyna O'Reilly
Practical Class Organiser
June 2017

## Crystallography Class Coursework

**Candidates:** **36**
**Mean mark:** **92.54%**
**Maximum mark:** **98%**
**Minimum mark:** **83%**

Detailed comments on the coursework are as follows:

| Demo No | Average Mark | Highest Mark | Lowest Mark |
|---|---|---|---|
| D1 | 8.20 | 10 | 5 |
| D2 | 9.04 | 10 | 8 |
| D3 | 8.76 | 10 | 7 |
| D4 | 8.96 | 10 | 6 |
| D5 | 8.80 | 10 | 5 |
| D6 | 9.61 | 10 | 9 |
| D7 | 9.26 | 9.5 | 8.5 |
| D8 | 9.80 | 10 | 9 |
| D9 | 9.44 | 10 | 8.5 |
| D10 | 8.87 | 10 | 6.5 |
| D11 | 9.77 | 10 | 9 |
| D12 | 9.86 | 10 | 8.5 |



# Examination Conventions 2016/17
# Preliminary Examination in Materials Science

## 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 progression decision and/or classification of an award.

These conventions apply to the Preliminary Examination in Materials Science for the academic year 2016-17. 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. 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 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* in the Department and those nominations are submitted for approval by the Vice-Chancellor and the Proctors. In Prelims the examiners are called "moderators". Formally, moderators 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.

## 2. RUBRICS AND STRUCTURE FOR INDIVIDUAL PAPERS

Each of the five papers in Prelims, comprising the three Materials Science papers (MS1, MS2 & MS3), the Maths for Materials Science paper, and the Coursework Paper, are weighted equally towards the overall total for the Preliminary Examination. The moderators set the papers, but are advised to consult the course lecturers. The course lecturers are required to provide draft questions and model answers if so requested by the moderators. There are no external examiners for Prelims. The assessed work for the practicals and the crystallography classes together constitute the Coursework Paper.

*Written Paper Format*

The Materials Science papers 1 - 3 comprise eight questions from which candidates must attempt five. Each question is worth 20 marks. The maximum marks available for each of these papers are 100.

The Prelims paper on Maths for Materials Science consists of two sections; candidates are required to answer all questions in Part A and 4 from Part B. The total marks available for this paper are 180; the mark achieved then being weighted by a factor of 0.555' such that the paper contributes a maximum of 100 marks to the Preliminary Examination.

*Coursework paper*

The Coursework Paper comprises two elements of coursework: a set of eight reports of practical work as specified in the MS Prelims Handbook (normally each individual report within the set has been marked already as the laboratory course progresses); and a set of reports for crystallography (completed under the class schedule).

For formal submission of the practical coursework, the Examination Regulations stipulate that candidates are required to submit the Materials Practical Class reports to the Chair of Moderators by no later than 10 am on Friday of the sixth week of Trinity full Term. Further information on this is provided in the Materials Prelims Handbook.

The only types of calculators that may be used in examinations are from the following series:

CASIO fx-83
CASIO fx-85
SHARP EL-531

Candidates are not permitted calculators in the Mathematics for Materials examination. SMP tables are provided in all Preliminary examinations.

* for the 2016-17 examinations the Nominating Committee comprised Prof Grant & Dr Taylor.

## 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 are 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*

During the marking process the scripts of all written papers remain anonymous to the markers. Each written paper is marked by a single moderator. Those papers identified by the moderator as having marks close to the boundaries of pass/fail and distinction/pass will be fully marked by a second moderator, who has sight of the first moderator's marks, but arrives at a formal independent mark. If the difference in these marks is small (~10% of the total available for the question, 2-3 marks for most questions), the two marks are averaged, with no rounding applied. Otherwise the moderators identify the discrepancy and read the answer again, either in whole or in part, to reconcile the differences. If after this process the moderators still cannot agree, they seek the help of the Chair, or another moderator as appropriate, to adjudicate. For all other papers, the second moderator checks that the overall mark for each question is consistent with one of three sets of descriptor(s), namely those for <40, 40 to 69, or >= 70 as appropriate. An integer total mark for each paper is awarded, where necessary rounding up to achieve this.

First year practicals are assessed on a continual basis by the senior demonstrators. The work for the twelve crystallography classes is assessed by the Crystallography Class Organiser(s), the first of these classes being assessed formatively only. Satisfactory performance in the practical work and in the crystallography classes is defined in the MS Prelims Handbook. The Practical Class Organiser reviews the marks for the practicals before they are considered by the moderators, 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 moderators review the crystallography and practical marks.

### *3.4 Scaling*

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

### *3.5 Short-weight convention and departure from rubric*

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 their cover sheet which questions, up to the prescribed number, they are submitting for marking. Excepting section A of the Maths paper, for which all questions are compulsory, if the cover slip is not completed 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 for MS1, MS2 & MS3 and out of 180 for the Maths for Materials Science paper.

***3.6 Penalties for late or non-submission***

The Examination Regulations stipulate a specific date for submission of the practical coursework. Rules governing late submission of the practical element 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 2016/17 Regulations).

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

(a) With permission from the Proctors under para 14.7 no penalty.
(b) With permission from the Proctors under paras 14.9 and 14.10, 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 and to any advice given in the Proctors' "Notes for the Guidance of Examiners and Chairmen of Examiners". The reduction may not take the mark below 40% of the maximum available for the piece of work.
(c) Where the candidate is not permitted by the Proctors to remain in the examination, he or she will be deemed to have failed the examination as a whole.
(d) Where, without the permission of the Proctors under paras 14.9 and 14.10, work is proffered so late that it would be impractical to accept it for assessment a mark of zero shall be recorded and, as per the Special Regulations for the Preliminary Examination in Material Science, normally the candidate will have failed the Examination as a whole.
(e) Where no work is submitted a mark of zero shall be recorded and, as per the Special Regulations for the Preliminary Examination in Material Science, normally the candidate will have failed the Examination as a whole.

Where an element of coursework 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 Moderators, permit the candidate to remain in the examination. In this case for the *element of coursework in question* (i) the Examiners will award a mark of zero and (ii) dispensation will be granted from the Regulation that requires a minimum mark of 40% if the candidate is not to fail 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 MS Prelims Handbook and are **separate** to the provisions described above.

The consequences of late submission of or failure to submit individual practical reports or individual pieces of Crystallography coursework are set out in the Prelims Handbook (sections 9.6 and 10 of the 2016/17 version) and are **separate** to the provisions described above.

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

This is not applicable to the Prelims examination.

### *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 D of the Materials Prelims Handbook and https://www.ox.ac.uk/students/academic/guidance/skills/plagiarism)

If plagiarism is suspected, the evidence will be considered by the Chair of the Moderators (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 Moderators 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. 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).

(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).

## 4. PROGRESSION RULES AND CLASSIFICATION CONVENTIONS

### *4.1 Qualitative descriptors*

Qualitative descriptors, based on those used across the Mathematical, Physical and Life Sciences Division, are given 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. |
| 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 |

### *4.2 Final outcome rules (Distinction, Pass, Fail)*

The pass/fail border is at 40%.

The Moderators may award a distinction to recognise especially strong overall performance. Normally (i) at their discretion, the moderators may specify a mark in the range 70% to 79% such that candidates with an overall mark greater than or equal to this specified mark are awarded a distinction and (ii) a distinction will be awarded to all candidates with an overall mark of 80% or greater.

### *4.3 Progression rules*

To pass the examination and progress to Part I, candidates are required to satisfy the moderators in all five papers, either at a single examination or at two examinations in accordance with the re-sit arrangements detailed below.

Failure in one or two written papers may be compensated by better performance in other written papers provided the candidate obtains at least 35% on the failed paper. Failure of three papers precludes compensation. Where compensation is permitted, only those marks in excess of 40 on a passed paper may be used towards compensation and normally this shall be at a rate of 3 marks to every deficit mark to be compensated.

For example, if two written papers are passed and marks of 36% and 38% are obtained in the remaining two written papers then the total for the four written papers must be at least 172 marks {36 + 38 + 2x40 + **3**×(4+2)} for both failures to be compensated

The Moderators have the authority to use their discretion and consider each case on its merit.

Failure of the coursework paper will normally constitute failure of the Preliminary Examination. Materials coursework cannot normally be retaken. Exceptionally a candidate who has failed the coursework may be permitted jointly by the Moderators and the candidate's college to retake the entire academic year.

## 5. RESITS

Candidates who pass the coursework paper and fail one or two written papers will be asked to resit only those written papers.

Candidates who pass the coursework paper and fail more than two written papers will be asked to resit all four written papers.

The resits usually take place in September. To pass a resit paper the candidate must obtain at least 40%, and normally no compensation is allowed. There is only one opportunity to resit the examination, and failure to pass a resit examination normally results in the candidate being prohibited from progressing to Part I. Exceptionally, a college may allow a student to suspend studies for a year and take Prelims a second time the following June.

The Moderators have the authority to use their discretion and consider each case on its merit. In such cases they will take into account a candidate's profile across all elements of assessment together with, subject to guidance from the Proctors where appropriate, any other factors they deem to be relevant.

## 6. FACTORS AFFECTING PERFORMANCE

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 board will meet to discuss the individual applications and band the seriousness of each application on a scale of 1-3 with 1 indicating minor impact, 2 indicating moderate impact, and 3 indicating very serious impact. When reaching this decision, examiners will take into consideration the severity and relevance of the circumstances, and the strength of the evidence. Examiners will also note whether all or a subset of papers were affected, being aware that it is possible for circumstances to have different levels of impact on different papers. The banding information will be used at Part B of the meeting of the internal examiners at which the raw examination results are reviewed. Normally, this FAP meeting will take place after Part A of the meeting of the internal examiners at which the raw examination results are reviewed. Further information on the procedure is provided in the *Policy and Guidance for examiners, Annex C* and information for students is provided at www.ox.ac.uk/students/academic/exams/guidance. It is very important that a candidate's FAP 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.

## 7. DETAILS OF EXAMINERS AND RULES ON COMMUNICATING WITH EXAMINERS

The Moderators in Trinity 2017 are: Prof Harish Bhaskaran, Prof. Kyriakos Porfyrakis, Prof. Susie Speller (Chair) and Prof. Andrew Watt. It must be stressed that to preserve the independence of the Moderators, candidates are not allowed to make contact directly about matters relating to the content or marking of papers. Any communication must be via your college, who will, if the matter is deemed of importance, contact the Proctors. The Proctors in turn communicate with the Chairman of Prelims.

### Annexe

**Summary of maximum marks available to be awarded for different components of the MS Preliminary Examination in 2017:**

| **Component** | **Mark** |
|---|---|
| Materials Science 1: Structure of Materials | 100 |
| Materials Science 2: Properties of Materials | 100 |
| Materials Science 3: Transforming Materials | 100 |
| Mathematics for Materials Science | 100 |
| Coursework Paper: | |
| Crystallography Classes | 50 |
| Practicals | 50 |
| ***Total*** | ***500*** |

# 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 | | |
|---|---|---|---|---|---|---|
| | 2016/17 | 2015/16 | 2014/15 | 2016/17 | 2015/16 | 2014/15 |
| Distinction | n/a | n/a | n/a | n/a | n/a | n/a |
| Pass | 28† | 33** | 28* | 100 | 100** | 100* |
| Fail | 0 | 0 | 0 | 0 | 0 | 0 |

† [redacted]
* [redacted]
** [redacted]

(2) **If vivas are used**
As stated in the Examination Conventions, vivas are no longer 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**

There were no new procedures or examining methods introduced this year.

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

This year's examiners (3 out of 6 of whom differ from last year) still have concerns about the FAP procedures. We consider that the current FAP process places the burden on the student to ensure the provision of all material that can be considered, including in getting other bodies (college, doctor etc.) to submit information on their behalf at a time when they are likely coping with the effects of illness or particular difficult circumstances that affect their performance to be able to do such things. This contrasts with the previous system in which further clarification or evidence could be sought if necessary. It is our view devolving decision making to the individual Examination Boards is likely to generate inconsistency in how mitigating circumstances are treated, which may in turn risk the University's reputation for fairness. A more centralised process at Divisional or University level would help achieve a consistent approach and be more in line with other institutions. The wealth of experience in dealing with mitigating circumstances accumulated over many years within the Proctors Office is not available within the individual Examination Boards. Serious consideration should be given to returning FAPs to the Proctors Office and if necessary increasing the resource available there. We recognise that the Examiners are best placed to assess how marks may be adjusted given a case, but only once a case has gone through the Proctors office to assess the validity and impact and conduct to any further enquiries.

**D. EXAMINATION CONVENTIONS**

The current year's Conventions were put on the Departmental website and sent electronically, along with other information in a letter from the Chair of Examiners to all candidates on 22 February 2017. 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 28 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. One candidate 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 (six 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 Options Paper 1, 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. For Options Paper 2, candidates were offered twelve questions in six 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, but, after consideration of the candidates, this was not applied by the examiners this year for any of the candidates.

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 a little above the mid-range of the 2(i) band. All MS and MEM general papers and option papers results were considered. After extensive deliberation, and in accord with the Conventions, the examiners decided that no scaling was necessary. GP1, GP2 and GP4 were toward the middle of the 2(i) band, with OP1 at the bottom of the 2(i) band, and OP2 at the top of the 2(ii) band. GP3 was at the lower end of the 1st class band. All MS and MEM General Paper and Option Paper results were considered by the examiners and it was agreed that the papers were fair.

## 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 65.10%, F 63.81% (Overall 64.5%)
Coursework Averages – M 72.07%, F 71.93% (Overall 72.0%)
Overall Part I Averages – M 66.84%, F 65.84% (Overall 66.38%)

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 ±10.9% points for the male candidates and ±10.1% points for the female candidates. Both male and female groups of candidates performed better in the coursework than in written examinations.

| | Overall mark | | Written Examinations | | Coursework | |
|---|---|---|---|---|---|---|
| mark (%) | Male | Female | Male | Female | Male | Female |
| 30-40 | | - | - | - | - | - |
| 40–50 | - | 1 | 1 | 2 | - | - |
| 50–60 | 4 | 1 | 5 | - | - | - |
| 60–70 | 6 | 7 | 6 | 7 | 4 | 3 |
| 70–80 | 3 | 4 | 1 | 4 | 11 | 10 |
| 80–90 | 2 | - | 2 | - | - | - |
| Totals | 15 | 13 | 15 | 13 | 15 | 10 |

**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**

[redacted]

**F. NAMES OF MEMBERS OF THE BOARD OF EXAMINERS**

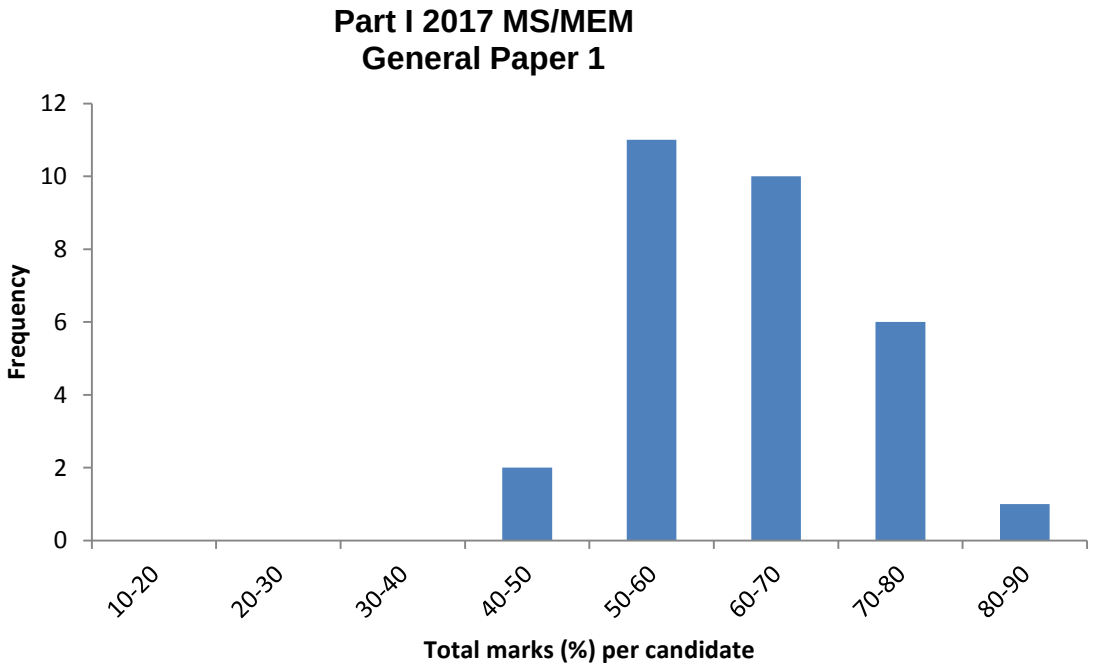
| | |
|---|---|
| Prof. T.J. Marrow (Chair) | Prof. P.S. Grant |
| Prof. H.E. Assender | Prof. S. Lozano-Perez |
| Prof. M.R. Castell | Prof. J.R. Yates |
| Prof. A.J. Davenport (external) | Prof. M.J. Reece (external) |

## General Paper 1 – Structure and Transformations

**Examiner:** **Professor Sergio Lozano-Perez**
**Candidates:** **30 (28 MS / 2 MEM)**
**Mean mark:** **63.40%**
**Maximum mark:** **85%**
**Minimum mark:** **44%**

Detailed comments on the paper are as follows:

| Question | No of Answers | Average Mark | Highest Mark | Lowest Mark | Topic |
|---|---|---|---|---|---|
| 1 | 3 | 7.17 | 9.5 | 4 | Phase Transformations |
| 2 | 23 | 13.70 | 17 | 5.5 | Phase Transformations |
| 3 | 25 | 12.74 | 17.5 | 7 | Microstructures of Polymers |
| 4 | 11 | 8.82 | 16 | 5 | Diffusion |
| 5 | 24 | 14.04 | 18.5 | 5 | Surfaces and Interfaces |
| 6 | 21 | 11.81 | 18.5 | 4.5 | Corrosion and Protection |
| 7 | 29 | 13.38 | 17.5 | 9.5 | Corrosion and Protection |
| 8 | 14 | 12.14 | 15.5 | 9 | Powder Processing |



## General Comments

This paper had an average of 63.4%, which is similar to last year's (62.5%) and higher than two years ago (59.2%). The candidates displayed a good understanding of the topics involved, although only one candidate scored above 80 marks. This year, on the other hand, no candidate scored below 40. The most significant difference with respect to last year's performance is that many more candidates got marks in the 50-60 range, as opposed to the 60-70 range last year. All questions had an average score above 50% with the exception of 1 and 4.

## Specific Comments

1) This question required the students to identify materials through images of typical microstructures in part a) and to discuss how segregation revealed by atom-probe might have developed. It was not a very popular one, with only 3 students taking it and none of them managed to score above 50%. The question was not particularly difficult but the students might have felt "intimidated" by the presence of real images and data.

2) This "Phase transformations" question required the students to use thermodynamics and kinetic theory to explain the origin of dendrites in cast alloys, derive equations to explain diffusion and discuss limitations of the approach. The average mark was ~70%, generally a good performance.

3) This question from the Polymers course covered topics that were clearly identified in the lecture notes. Candidates were asked to describe factors affecting polymer solubility, describe the formation of spherulites and answer a series of questions relating melting point and glass transition temperatures. The answers were adequate on average and contained most of the key pieces of information required although the writing style tended to be disorganized and lacking structure. The average mark was 44%, which is significantly lower than the 63% achieved las year. The highest was 87%. This question was chosen by 76% of the candidates (3$^{rd}$ most popular choice).

4) This question focused on the understanding of diffusion in metals. Most topics were fully covered in the lectures, with some sections requiring an extra effort. All sections required the use of analytical expressions and derivation of equations. This was the 2$^{nd}$ least popular question with ~30% of the students taking it. The average mark was 60% and the highest 80%.

5) The question on surfaces and interfaces required the students to discuss how the grain boundaries differ from the bulk, their thermodynamical properties, morphology and formation. Most topics were covered in detail in the lectures and tutorials. The students showed a good understanding of the topic, with an average mark of 70% and the highest of 92%.

6) The first corrosion question covered the topic of galvanic corrosion. It combined a mixture of basic concepts with a more unconventional case study that should test the students' skills. In general, the students performed well, with 70% of the students attempting it and an average mark of 60%.

7) The 2$^{nd}$ corrosion question covered the topic of pitting and crevice corrosion, both well discussed during lectures and tutorials. The first section required a "textbook" answer, while the second one needed the calculation of a Pourbaix diagram (same one as covered in the lectures) and the discussion of a potential degradation if the initial conditions where not ideal. This was the most popular question, with 97% of the students choosing it. The average mark was 67%.

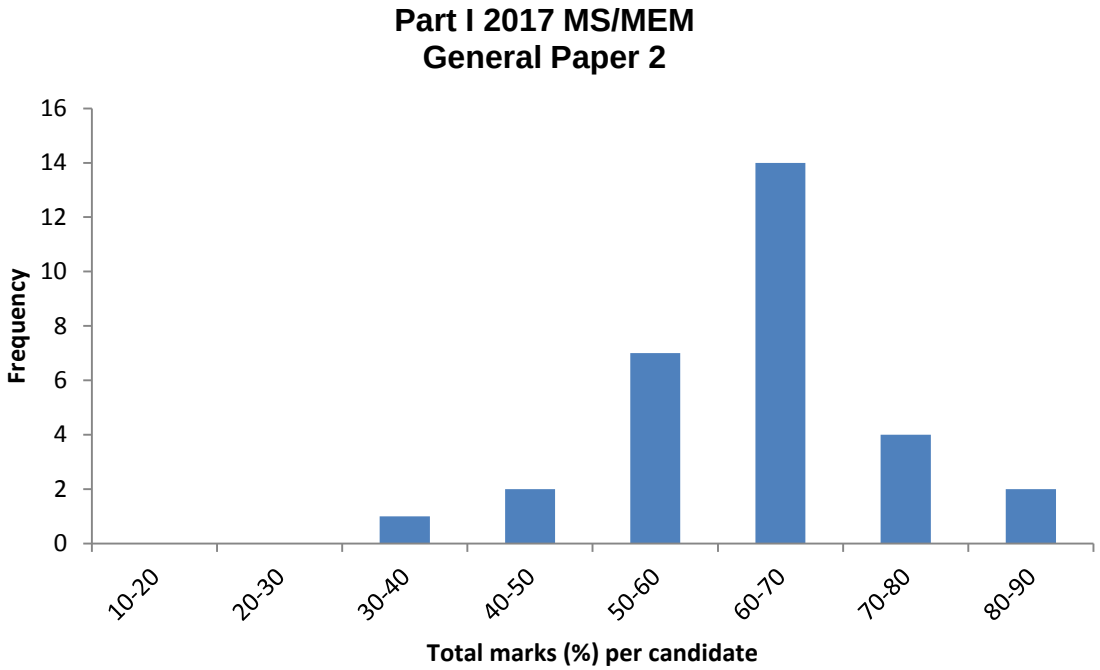
8) The powder processing question combined two "textbook" sections on sintering and die pressing with another one where the students were asked to derive an analytical expression that explained some crucial aspects of consolidation during sintering. These first two sections were harder to mark since the students' answer did not necessarily follow the "script" of the model answer provided. Some keywords and key concepts were identified and marked accordingly. This question was attempted by 46% of the students with an average mark of 60%.

## General Paper 2 – Electronic Properties of Materials

**Examiner:** **Professor Jonathan Yates**
**Candidates:** **31 (28 MS / 3 MEM)**
**Mean mark:** **64.26%**
**Maximum mark:** **94%**
**Minimum mark:** **39%**

Detailed comments on the paper are as follows:

| Question | No of Answers | Average Mark | Highest Mark | Lowest Mark | Topic |
|---|---|---|---|---|---|
| 1 | 14 | 7.54 | 13.5 | 3.5 | Tensors |
| 2 | 25 | 11.42 | 19 | 2.5 | Magnetic Properties |
| 3 | 21 | 12.69 | 18.5 | 2 | Quantum Mechanics |
| 4 | 30 | 15.63 | 20 | 9.5 | Statistical Mechanics |
| 5 | 30 | 13.70 | 19.5 | 6 | Electronic Structure of Solids |
| 6 | 16 | 12.03 | 19.5 | 4.5 | Electronic Structure of Solids |
| 7 | 0 | n/a | 0 | 0 | Electrical and Optical Properties |
| 8 | 19 | 13.16 | 19 | 6.5 | Semiconductors |



## General Comments

Overall a good distribution of marks clustered around the 2:1 bracket. There were some excellent scripts with candidates displaying an impressive understanding of the topics. Weaker students got caught up in the detail of the maths, and failed to show a broader understanding. With the exceptions of Q1 and Q7, full or near full marks were obtained by at least one candidate on each question. For the 2nd year running the question on electrical and optical properties proved unpopular (1 attempt in 2016, 0 in 2017). In both cases this is probably because the questions appear unfamiliar. Candidates need to be aware that "unfamiliar" does not necessarily mean "difficult".

## Specific Comments

1) This was a more difficult tensors question than set in 2016. Several candidates correctly set up the problem in (b) and applied the appropriate rotation. Frustratingly, no candidate then took the more trivial final step to use the dimensions of the cylinder to find the answer in K. In (c) a few candidates showed how the representation quadric could be used to estimate the temperature difference, however, no candidate made a credible attempt at producing a numerical answer.

2) The early parts of this question were bookwork. The final part was similar to a tutorial question. Essentially it involved substituting numbers into the question provided. However, candidates found creative ways to get this wrong – common errors included wrong values for the atomic number of carbon, and not knowing the crystal structure of diamond. Such things should be general knowledge for a Materials finalist.

3) This was a well-structured question on the way quantum mechanics gives rise to the periodic table. It started with bookwork and ended with a novel question on the electronic configuration of an ion. Surprisingly, only a few candidates made a serious attempt at (a) and not many gain more than half the marks. In (b) not many candidates could explain why lower angular momentum states are occupied first – "because they have lower energy" was a common answer, which didn't address the question. The later sections were answered rather better.

4) This was a pretty standard question using the Boltzman distribution. Generally well answered. In c-ii a few candidates lost marks by jumping too quickly to the answer provided in the question, without fully justifying their steps. The best candidates were able to obtain correct numbers for (d) on adiabatic demagnetisation.

5) This was a familiar looking question on band structures. Many candidates obtained good marks, and showed they had grasped the key concepts. Confusingly for b-i all candidates correctly copied the sketch, but very few put scales and units on the axis. No marks were obtained for just copying the sketch. Weaker candidates became confused finding the conduction band minima and were not able to relate their numerical answers to the figure provided.

6) This is very similar to a question on graphene from 2015. The 2015 question was poorly attempted with low scores, and it was appropriate to ask it again in a modified form. Pleasingly there were twice as many attempts, a higher mean score and a few candidates produced close to perfect solutions. Nevertheless the mean was brought down by a number of very low scores by candidates who struggled with the early part of the question.

7) There were no attempts at this question. This is a topic that has not been examined in recent years. I suspect that the sight of Maxwell's equations put candidates off attempting the question. In fact this was a fairly straightforward proof from the notes. However, the rest of the question was significantly less challenging. Some candidates would probably have improved their marks by attempting this question.

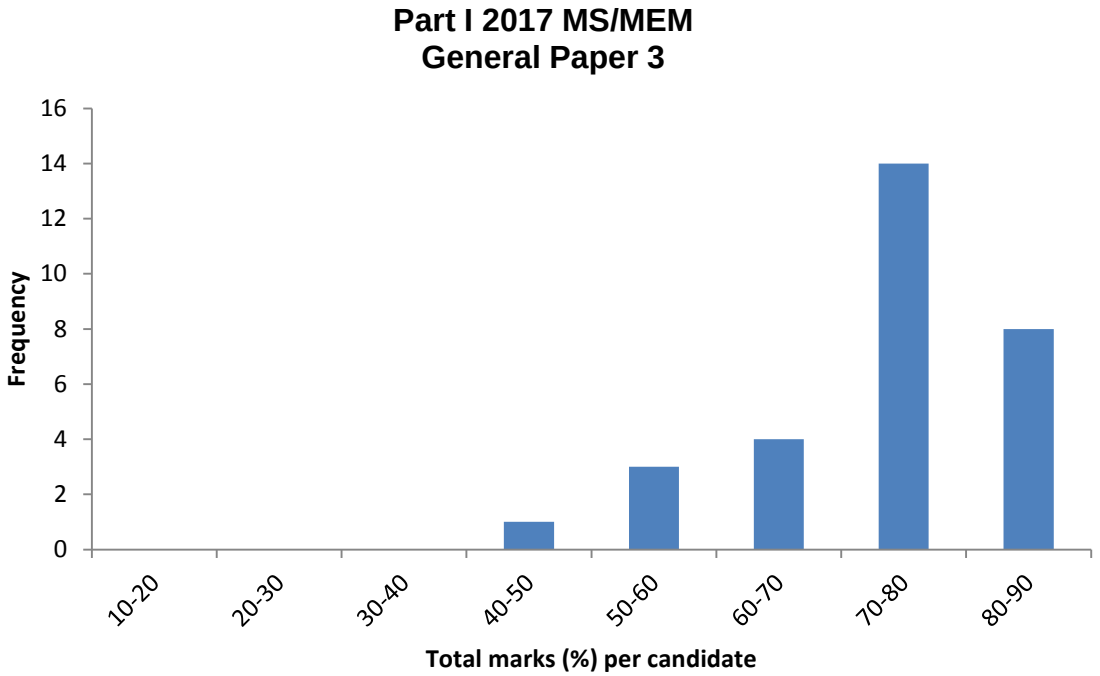
8) A question of two halves. The first required candidates to discuss the influence of various dopant atoms on the conductivity. Some candidates were let down by a poor grasp of the periodic table. The second part was a derivation of the number of electrons in the conduction band. There were a number of very clear derivations – but the assumptions used were not always clearly explained. A few candidates did not do the key substitution correctly, but still ended up obtaining the desired formula – this did not earn many marks.

## General Paper 3 – Mechanical Properties

**Examiner:** **Professor James Marrow**
**Candidates:** **31 (28 MS / 3 MEM)**
**Mean mark:** **74.74%**
**Maximum mark:** **91%**
**Minimum mark:** **50%**

Detailed comments on the paper are as follows:

| Question | No of Answers | Average Mark | Highest Mark | Lowest Mark | Topic |
|---|---|---|---|---|---|
| 1 | 16 | 14.31 | 19.5 | 6.5 | Macroplasticity |
| 2 | 26 | 15.12 | 19 | 9 | Microplasticity |
| 3 | 22 | 14.66 | 18.5 | 9.5 | Mechanical Properties of Polymers |
| 4 | 11 | 13.73 | 17.5 | 4 | Microplasticity |
| 5 | 17 | 12.35 | 16 | 4 | Fracture |
| 6 | 7 | 14.07 | 19 | 10 | Creep |
| 7 | 30 | 16.58 | 19.5 | 11 | Elastic behaviour in isotropic materials |
| 8 | 26 | 15.54 | 19.5 | 4 | Mechanical Properties of Composites |



## General Comments

The mean mark for the paper was 74.74% (nearly 15 percentage points greater than last year) with a peak in the distribution in the first class band, but also a long, 'tail' into the lower marks. There was a quite even distribution of questions answered, with no questions that had significantly higher or lower ranges of marks.

## Specific Comments

1) **Macroplasticty**. A range of questions on texture, physical principles of metal forming and plastic instability. a) Descriptions of texture tended to omit reference to limited set of crystallographic orientations relative to processing axis and limited detail provided on how texture is actually measured in the descriptions of methods to measure texture. b) Balance of factors in wire drawing well explained, but many answers neglected the importance of yield criterion being satisfied to connect the stresses due to friction to the compressive load that shows the friction hill. c) Some derivations of the onset on necking were insufficiently complete, beginning the derivation with the equation for the yield point. d) Most recalled the yield criterion correctly, however

2) **Microplasticity:** A popular question, answered by almost all candidates that considered mechanisms of interaction between dislocations and precipitates, calculation of the contribution of precipitates to strength and consideration of additional strengthening mechanisms and the effect on work hardening due to aging of an aluminium alloy; a) some candidates incorrectly offered Orowan bowing, which is not specifically an interaction; b), many did not calculate the change in tensile yield strength, having calculated the change in shear stress (some incorrectly calculated the burgers vector); c) was generally well answered through some provided less detail on the behaviour before peak aging than afterwards.

3) **Mechanical Properties of Polymers**: A question on the effect of temperature on the mechanical properties and glass transition of PMMA that was answered by the majority of candidates. a) many included unnecessary information on microscopic modes of deformation) instead of macroscopic, and most did not correctly identify the occurrence of non-linear (visco) elastic deformation or identify that failure is brittle except at 60°C; b) a few poor measurements and calculation errors; c) mostly well answered, though not all were clear on the role of bond rotations and nearly all underestimated Tg (indicated by high modulus even at 60°C); d) well answered by most

4) **Microplasticity**: Attempted by about half the candidates, with some perhaps put off by the need to apply vector/tensor methods to calculate forces on dislocations. a) most did not mention a driving force for the change in loop size; b) some did not use correct notation to indicate tensor c) the sign and sometime magnitude of the burgers vector were incorrectly determined by some; d); generally correct, though magnitude of burgers vector sometime incorrect, e) mostly correct; f) most identified the correct movement, but did not consider that a jog would form.

5) **Fracture:** A question concentrated on the size requirement for valid fracture toughness measurements that was attempted by over half the candidates. a) most answers did not explain the relationship between stress intensity factor and the magnitude of the stress field, nor why there is a critical stress intensity factor or what it represents; b) mostly correct, but many missed link between plastic zone and toughness and factors that control plastic zone size; c) mostly correct although some errors in units and magnitude; d) some did not verify whether the size requirement was satisfied and a surprising number thought that an indentation would produce a sharp crack in a ductile metal (it does not).

6) **Creep**: An unpopular question that mostly required plotting a creep mechanism map using the equalities between the different mechanisms, This first part was generally done well and some students achieved nearly full marks. a) most made errors in plotting the chart, having done the calculations correctly: b) low marks where answers on the expected dislocation microstructures and creep mechanisms were incomplete (i.e. no clear description of microstructures)

7) **Elastic behaviour in isotropic materials.** The most popular question that was done by almost all candidates. It included some material on Moht's circle from Prelims (Elasticity and Structures) a) well answered by almost all; b) This was similar in form to a derivation from tutorials (albeit a different problem) and was generally well done, but quite a few applied the yield criterion incorrectly.

8) **Mechanical Properties of Composites:** This popular question answered well by most candidates, and was concerned with the elastic properties of fibre-reinforced composites: a) not all discussed in terms of shear stress, critical length and elastic properties (i.e. stiffness, not strength) and many did

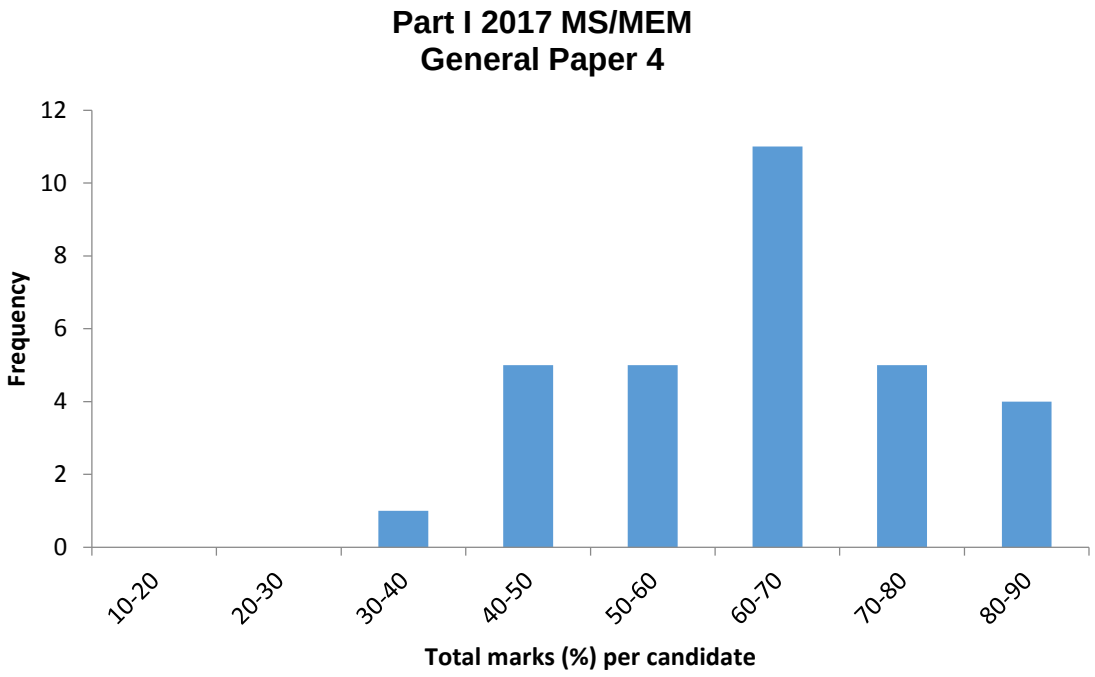
not provide good examples with details of fibre, matrix and application; b) some made errors with the sign and magnitude of the Poisson ratio effects; c) some performed the matrix multiplication incorrectly or made rounding errors; d) some did not clearly identify the effect of the anisotropy of elastic properties on the relation between axes of principal stress and strain.

## General Paper 4 – Engineering Applications of Materials

**Examiner:** **Professor Hazel Assender**
**Candidates:** **31 (28 MS / 3 MEM)**
**Mean mark:** **64.65%**
**Maximum mark:** **89%**
**Minimum mark:** **40%**

Detailed comments on the paper are as follows:

| Question | No of Answers | Average Mark | Highest Mark | Lowest Mark | Topic |
|---|---|---|---|---|---|
| 1 | 28 | 12.54 | 18 | 5 | Materials Characterization |
| 2 | 30 | 13.53 | 20 | 5.5 | Materials Characterization |
| 3 | 31 | 14.94 | 20 | 10.5 | Ceramics |
| 4 | 13 | 11.15 | 17 | 5.5 | Ceramics |
| 5 | 17 | 12.00 | 15.5 | 7.5 | Physical Metallurgy |
| 6 | 4 | 12.00 | 17 | 4 | Physical Metallurgy |
| 7 | 12 | 11.79 | 15.5 | 5 | Polymers |
| 8 | 20 | 11.58 | 18 | 6.5 | Device Materials |



## General Comments

The paper produced a reasonable spread of marks and thus discriminating between the best, good and less good students, with a mean mark very close to 65%. The distribution of marks is similar to last year. Inevitably some questions were more popular than others (as last year, the Materials Characterization and Ceramics questions were the most popular) but with a reasonable spread. The most popular three questions attracted the highest mean mark, but not to an alarming degree.

## Specific Comments

1) **Materials Characterization**. Abbe theory and electron diffraction. One of the most popular questions. a) Abbe theory – many candidates could describe image formation, but often only defined resolution, and did not address the ultimate limit at 90degrees. b) Some confusion between SAD and dark field imaging, or imaging and diffraction. c) Indexing the diffraction pattern was generally done well, there was some confusion between fcc, bcc and diamond structure. Some candidates missed that the angle of diffraction is 2theta and some algebraic slips in the calculation. The final two-mark section was challenging, but quite a few candidates could identify which spots would contribute to the image.

2) **Materials Characterization**. Scanning Probe Microscopy. One of the most popular questions. a) A surprisingly poor answer by some on what is quite a 'standard' question section on magnification in scanning microscopy – the answers often related to sensitivity and mode of imaging rather than magnification, b) well answered section on requirements for STM, c) often couldn't justify why there was no need for conductivity in AFM samples, d) well answered derivation and calculation on tunnelling current, e) poorly answered section on resolution of imaging – some confusion between variations in height of surface rather than profile of tip.

3) **Ceramics**. Sintering. The most popular question (with the other ceramics question being significantly less popular), attracting the greatest mean mark. a) Why powder methods – often candidates focussed on 'why powder' without justifying why more conventional routes, such as melt casting, were not used, b) mechanisms of sintering – even distribution of marks over different aspects of the question, c) factors affecting densification on sintering - even distribution of marks over different aspects of the question.

4) **Ceramics**. Mechanical properties and materials selection. a) mechanical properties – many answers started from the assumption of a brittle material, rather than justifying this for ceramics, b) consideration of materials options for a drinking cup – a notable number of answers did not attempt to describe the manufacturing process, despite it being explicitly solicited by the question. Answers were often weak on the details of chemistry or microstructure, c) advantages/disadvantages of materials choices – usual reason for loss of marks was failure to complete all sections.

5) **Physical Metallurgy**. Ni-based superalloys. a) Al, Cr and W alloying elements – W the weakest, b) predominant phases – well answered, c) poorly answered section on grain alignment – most made little headway, d) poorly answered section on thermal fatigue with many candidates making little headway: some were able to describe how E varies with orientation.

6) **Physical Metallurgy**. Iron and steelmaking. a) Blast furnace – good descriptions on the whole, b) concentration of C in pig iron, very poorly answered, c) steelmaking – weakest on variants to the technique, d) electric arc furnace – mostly made the majority of key points on the reasons to use EAF.

7) **Polymers**. Solid polymer electrolytes. a) General properties of polymers for electronics – well answered, b) solid polymer electrolytes – modestly good: some candidates confused conjugated polymers with cationically conducting polymers. There were good responses in section (iii), a section that required some thinking, c) polymer/salt composites: few candidates considered the role of the salt, but good consideration of temperature and alignment.

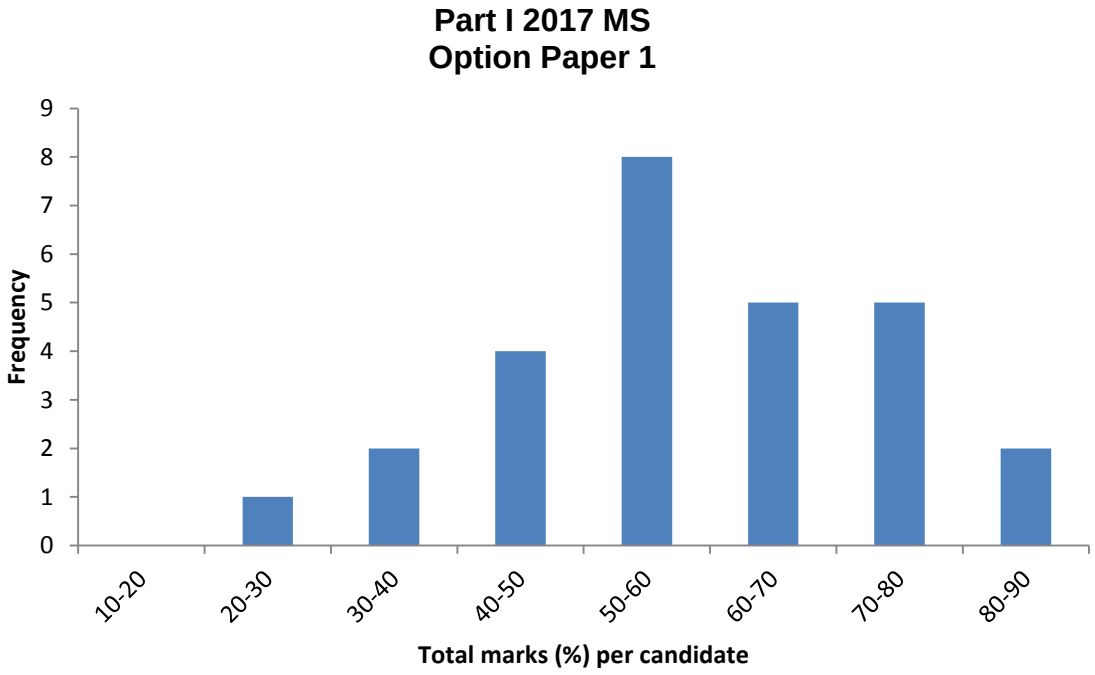
8) **Device Materials**. p-n junctions including degenerately doped junctions. a) p-n junction giving asymmetrical response: generally good answers with some confusion between drift and diffusion and most candidates did not explain the origin of band bending, b) degeneratively doped p-n junction, part ii) on the I-V characteristic was poorly answered – the candidates often could not generate the current output despite having band diagrams at the various voltages, part iii) on application was mostly either not answered or was incorrect.

## Materials Options Paper 1

**Examiner:** **Professor Martin Castell**
**Candidates:** **28 (MS)**
**Mean mark:** **60.96%**
**Maximum mark:** **94%**
**Minimum mark:** **29%**

Detailed comments on the paper are as follows:

| Question | No of Answers | Average Mark | Highest Mark | Lowest Mark | Topic |
|---|---|---|---|---|---|
| 5 | 2 | 14.75 | 19.5 | 10 | Strength and Failure |
| 2 | 22 | 12.50 | 22.5 | 4.5 | Strength and Failure |
| 3 | [redacted] | [redacted] | [redacted] | [redacted] | Nanomaterials |
| 4 | [redacted] | [redacted] | [redacted] | [redacted] | Nanomaterials |
| 5 | 9 | 20.11 | 24.5 | 10 | Prediction of Materials Properties |
| 6 | 13 | 15.08 | 23 | 3.5 | Prediction of Materials Properties |
| 7 | 8 | 16.63 | 24 | 9 | Optics and Optoelectronics |
| 8 | 10 | 14.80 | 20 | 10 | Optics and Optoelectronics |
| 9 | 19 | 12.50 | 18 | 6 | Engineering Ceramics |
| 10 | 28 | 17.21 | 23.5 | 2 | Engineering Ceramics |



## General Comments

The average for this paper was 61%, which falls within the aspirational range for papers in general. This indicates that as a whole, the paper was set at an appropriate level of difficulty. There was a broad range of marks, allowing the stronger students to distinguish themselves. The most notable aspect of this paper was the distributions of questions that the students answered. There were three questions that were particularly unpopular and were answered by very few students, namely Q1 (2 answers), Q3 (1 answer), and Q4 (no answers). This must to some degree be a reflection on the courses related to these questions, especially "Nanomaterials", and this is something that should be addressed by the department. It should be noted that the "Nanomaterials" questions were also unpopular last year (2016), so this is not a statistical anomaly.

## Specific Comments

1) The question on "Strength and failure of materials" was only attempted by two students (~7%). It covered the effect of the microstructure on the mechanical properties of microalloyed steels. This is a topic covered in the lectures, with some of the subsections requiring textbook type answers and others analytical calculations. One student performed well with a mark of 78% while the other did not do as well, with a mark of 40%.

2) 22 students answered this popular "Strength and failure of materials" question related to precipitates and crack growth. The average, at 50%, was low, but this may have been because some students attempted this question based on their second year knowledge, and may not have attended the course. Some of the answers lacked precision in the language used and were often ambiguous or wrong in detail. The question in (c) was worded ambiguously, in terms of amplitude vs maximum for stress levels, but any errors based on this ambiguity were accounted for in the marking.

3) This "Nanomaterials" question [redacted] covered the topics of thermal transport, nanomanufacturing and transistors. All sections required textbook answers with some additional reading required to achieve full marks.

4) [redacted] this question on "Nanomaterials" [redacted] covered the topics of nanoparticle synthesis and growth in the first section, and carbon nanotube morphologies and photoluminescence in the second. These topics were covered in the lectures and were not particularly challenging.

5) Nine students answered this "Prediction of materials properties" question, generally well, resulting in a high 80% average mark. This may be in part because the question originally submitted by the lecturer was more difficult than the one seen by the students, following modification by the examiners. The question concerned a vibrating linear chain of atoms, with which the students should be familiar from lectures.

6) This "Prediction of materials properties" question was answered by 13 students, with a very broad range of results. Some students had difficulty from the beginning of the question, related to the electron distribution around a Li atom, and never really recovered, whilst others seemed to have no difficulty at all. Presumably this performance related in a somewhat binary way to whether the students had understood this part of the course or not.

7) This question on "Materials for devices for optics and optoelectronics" was answered generally quite well, by eight students. The question on dielectric materials involved fairly low level mathematical re-arrangements, that however did require an understanding of the material.

8) Ten students answered this "Materials for devices for optics and optoelectronics" question on radiation from the sun and solar cells. The distribution of marks was relatively tight, with none of the students performing particularly well or badly. It was disappointing to see that sections (b)ii and (d)i were answered particularly poorly although the answers involve only rudimentary mathematical manipulations.

9) This was the first question on "Engineering ceramics". It was attempted by 19 students (68%), with an average mark of 50% and a maximum mark of 72%. In section a) it presented the students with a series of cross sections of sintered alumina discs illustrating some manufacturing defects. The students identified them generally well, although their choice of words and explanations made the marking challenging in some cases. Section b) required the explanation of the effect of some variables in the thermal stress formula, which the students did generally well. Finally, section c)

covered some mechanical testing for failure of a series of alumina discs. The students were asked to calculate the probability of survival. Most students started well and set up the right equations to solve the exercise, although many made trivial mistakes in the calculations.

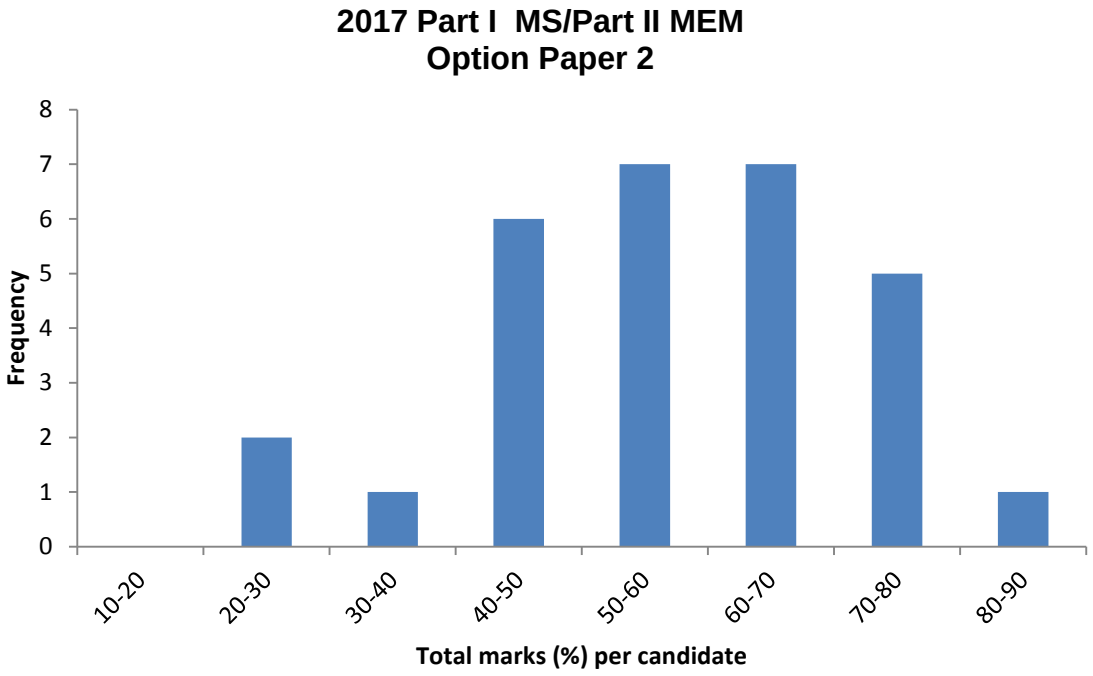
10) This was the second question on “Engineering ceramics”. It was attempted by all students (100%), with an average mark of 69% and a top mark of 94%. The first section consisted of a series of questions on methods to manufacture ceramics, discussing their advantages and disadvantages. This was a textbook type question and the students did well in general. The 2$^{nd}$ section presented the students with a plot of fracture toughness vs crack extension for two ceramics with different grain size. Further subsections asked for a description of the observed results and a discussion on how microstructure developed, the effect of grain size and an interpretation of the different features of the plots. Most students managed to grasp the key features and produce a satisfactory answer.

## Materials Options Paper 2

**Examiner:** **Professor Patrick Grant**
**Candidates:** **29 (28 MS / 1 MEM)**
**Mean mark:** **57.38%**
**Maximum mark:** **82%**
**Minimum mark:** **29%**

Detailed comments on the paper are as follows:

| Question | No of Answers | Average Mark | Highest Mark | Lowest Mark | Topic |
|---|---|---|---|---|---|
| 1 | 16 | 14.31 | 19 | 7.5 | Advanced Polymers |
| 2 | 17 | 14.71 | 23.5 | 3 | Advanced Polymers |
| 3 | 6 | 15.42 | 22 | 10.5 | Manufacture with Metals and Alloys |
| 4 | 6 | 15.67 | 20.5 | 5 | Manufacture with Metals and Alloys |
| 5 | 5 | 12.00 | 16.5 | 8.5 | Materials for energy prod$^{n}$, distrib$^{n}$ & storage |
| 6 | 13 | 11.81 | 19.5 | 5.5 | Materials for energy prod$^{n}$, distrib$^{n}$ & storage |
| 7 | 10 | 12.65 | 22 | 2.5 | Advanced Engineering Alloys and Composites |
| 8 | 6 | 9.67 | 16 | 6 | Advanced Engineering Alloys and Composites |
| 9 | 13 | 16.12 | 22 | 10 | Biomaterials and natural materials |
| 10 | 7 | 16.64 | 20 | 11.5 | Biomaterials and natural materials |
| 11 | 7 | 17.14 | 22 | 13 | Devices |
| 12 | 10 | 14.60 | 21.5 | 9 | Devices |



## General Comments

The paper average was slightly lower than intended but consistent with previous years. The external examiner commented that some questions seemed rather broad and "easy" while others were more focused and required more depth; however, the distribution of marks did follow these comments with the "easier" questions showing a similar range of average marks as the "harder" questions. Nonetheless, it might be appropriate to consider moving to a more consistent style of questions of significant depth that are more appropriate for a 3rd year course.

## Specific Comments

1. One of the most popular questions. (a) Almost universally correct. (b)(i) Well-answered; (ii) few fully correct answers with students struggling to link together the deficiencies of the free volume description with a more comprehensive description that explicitly met the deficiencies; (iii) generally good answers with most showing understanding of role that chain kinetics played in Tg and freezing in of disorder at higher cooling rates. (c)(i) Generally good description of polarisation response although the explicit mention of molecular rearrangement or reorientation of *polar groups* often missing; (ii) understood tan delta related to loss but usually failed to relate to definition of real and imaginary (or complex) permittivity; (iii) very poorly executed with candidates almost all failing to manipulate given equation into y = mc + c form.

2. Most popular. (a) Phase separation well described. (b) Good differentiation between (i) nucleation and growth and (ii) spinodal decomposition and reasonable sketches of concentration profiles; uphill diffusion not usually properly described. (c) Usually near complete answers describing difference between coherent and incoherent neutron scattering, and appropriate examples. (ii) Most students struggled to gain much more than half marks in describing techniques for measurement of the given properties of polymers, with "geometry of motion" apparently the most obscure. (d) Good differentiation and description of X-rays versus neutrons and (ii) selective deuteration.

3. (a) Generally well answered by those who recalled the correct process although some diagrams were lacking in identification of the important components. (b) Answers missed the role of excess Ti in the Al-Ti-B alloy used for grain refinement and were generally superficial on the mechanism of how the grain refiner worked; some did not explain well the benefits of grain refinement. (c) Almost no-one explained how melt convention occurred, but all identified its grain refining benefits and most identified some (but not all) methods currently used to promote liquid flow. (d) Few correctly identified conversion coating in addition to anodising, the level of detail on the processes was generally light, but most identified correctly the benefits.

4. One of the more quantitative questions that was less popular but answered well. (a) Students generally described the schematic arrangement of the solid/liquid interface appropriately and performed the algebraic derivation required. (b) Most students had a good concept of the argument for constitutional supercooling although some of the requested sketches were a bit vague for full marks. (c) Students struggled to take the learning from (i) simplify it and apply it in a new scenario of spheres rather than solid/liquid interface. (d) Required applying soldering knowledge combine with (c); poorly answered.

5. (a)(i) Some did not identify the pressures that lead to increased energy use, or note that electrical energy is currently a small fraction of total energy; (ii) quite a few did not correctly identify the meaning of "strategic" resource, or gave inappropriate examples; (b)(i) Greater clarity needed on difference between open and closed cycles and the effect of a closed cycle; (ii) descriptions of the physical processes of neutron capture and transmutation as a function energy was quite poor; (iii) not all gave a fast reactor example or did not explain clearly the selection the relevant material in terms of the conditions in that reactor. (c) Most gave superficial answers that did not explain well how the innovation would improve efficiency.

6. (a)(i) Good answers on difference between primary and delivered energy; (ii) most candidates could identify four types of storage but often their description lack details, especially of the relevant materials science. (b) Hydrogen production methods described okay, along with (ii) requirements for hydrogen storage materials although generally lacking in specific examples; (iii) rather weak and superficial

answers, often failing to give the required four examples. (c) A large number of student did not understand the difference between photovoltaics and concentrated solar power (CSP) and so many answers were inappropriate.

7. (a) Some descriptions of strengthening in martensitic structures were quite confused. (b) Most descriptions of the chemistry and processing of maraging steels were incorrect or confused. (c) Descriptions of the crystallographic changes from austenite to martensite were generally superficial in detail. (d) Fair descriptions of characteristics of orientation relationship provided, but it should be noted that observations of surface deformations are insufficient to observe an orientation relationship between crystals. (e) Most diagrams that used the common tangent to consider the thermodynamics of the phase transformation were drawn incorrectly.

8. Straightforward question on Ti alloys surprisingly unpopular and poorly executed. (a) About half of the answers failed to explain how the allotropic phase transformation in Ti is fundamental to its alloys' wide range of properties; not all candidates appreciated c/a differences between Ti and Mg. (b) Sketches of Ti rich end phase diagrams often looked more like stainless steel than Ti and a failure to give correct (i) alpha and (ii) especially beta eutectoid stabilising elements. (c) Good understanding of toughness versus fatigue strength aspects. (d) Rather superficial understanding and description of the microstructures: (i) little specific temperature, times etc for the thermomechanical processing parameters; (ii) solid answers but lacking detail in, for example, how fatigue cracks might interact with the microstructural features.

9. (a) Most identified the range of behaviours, but did not note that the spectrum addresses effect of tissue on material and effect of material on tissue. Most provided useful examples. (b) Most did not clearly explain that calcium phosphates can span the range from active, resorbable to inert, and while examples were given these were not clearly explained and some were duplicates of the same process. (c) Most answers focussed on the mechanical properties and neglected wider factors including inertness/ease of sterilisation, ease of fabrication and depth of existing metallurgical knowledge. (d) Quite a few offered cementing as an attachment method, although this is just an example within the wider classes of methods that utilise morphology, biology, bioactivity and biodegradability.

10. (a) Generally complete descriptions of method although choice of materials not well explained and some candidates seem to think silicon is a flexible polymer. (b) Generally most did not include points related to infection risk, pain and control of expansion rates. (c) Various approaches used to estimate the dimensions of the expander, but most did not consider reasons beyond just size in selecting the best expander (such as location and benefits to surgery)

    *Note: students might have been led astray by instruction in question that no dimension could be less than 1 cm, while the model answer arrives at a dimension of 0.3 cm. However, only one student clearly arrived at this solution and then discounted it. Several others arrived at an incorrect answer that was less than 1 cm. Full marks were awarded for that section in these cases.*

11. Relatively unpopular but straightforward question on superconducting materials, attracting high marks. a) most gave a fairly complete explanation of the Meissner effect, with some misunderstandings of the location the currents that expel the magnetic field and neglect to mention zero resistivity or diamagnetism; b) i) generally well answered though some did not explain how flux pinning occurs nor describe how superconductivity is lost at the upper critical field; b) ii) upper critical field identified, but none identified the lower critical field correctly as the point where the initial magnetisation curve becomes non-linear; c) generally well answered, though some examples and explanations of importance of flux pinning in applications of superconductors were lacking in detail ; d) generally solved correctly.

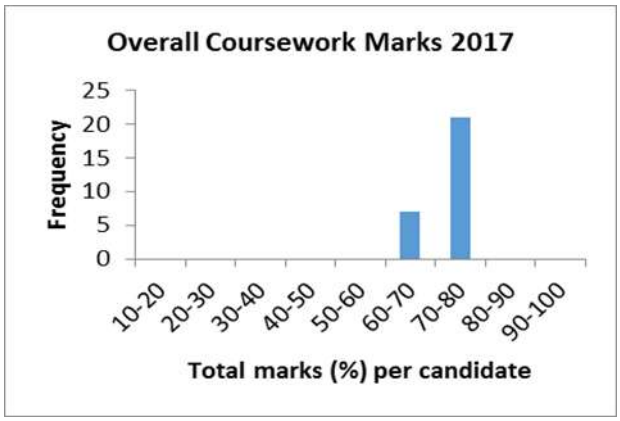
12. (a) Generally clearly answered, but few considered why spontaneous polarisation occurs, or the driving force for aging. (b) Most correctly described the mechanism of polarisation, but some incorrectly discussed doping, rather than grain size to maximise the polarisation value. (c) Reasons for low or near zero temperature coefficient were not clearly, and many offered doping incorrectly as a means to do this. Reasons for using mixtures of phases were not well described.

## COURSEWORK

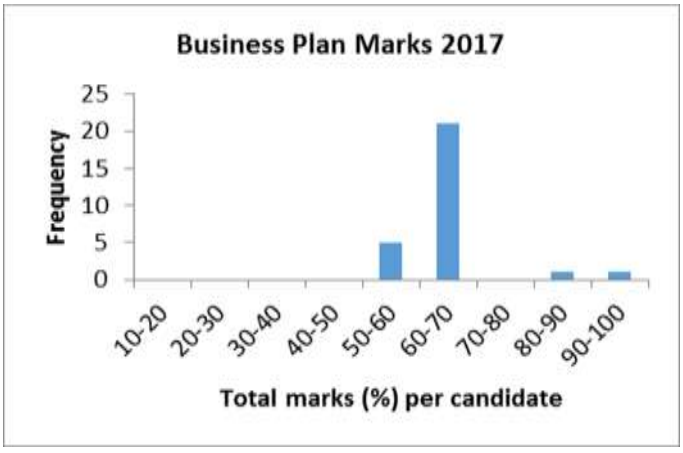
A maximum of 200 marks are available for Part I coursework which comprises:

- 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

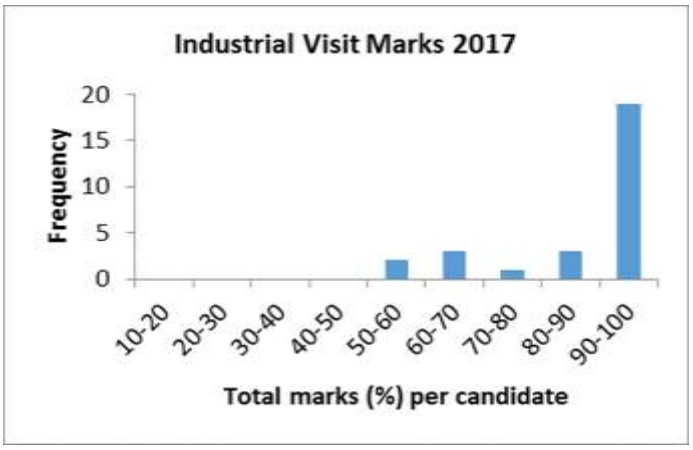
Overall coursework marks were good, and in the range expected for what is generally continuously assessed work. (The marks below reflect both MS and MEM results, where applicable.)



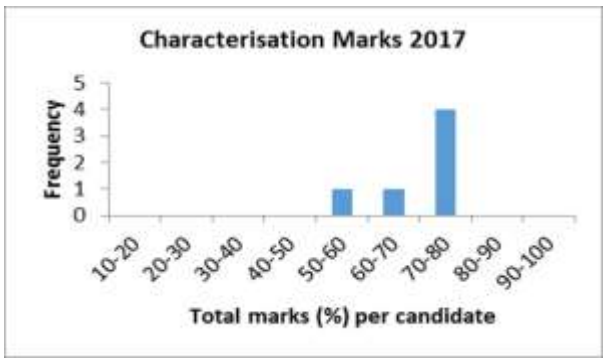

The **Business Plan** marks (average 63.0%) are in a narrow range except for the two outlier high marks that are for optional examined courses taken by two students. These marks are also high compared to the non-materials students that took these courses, and reflect individual excellent performance.

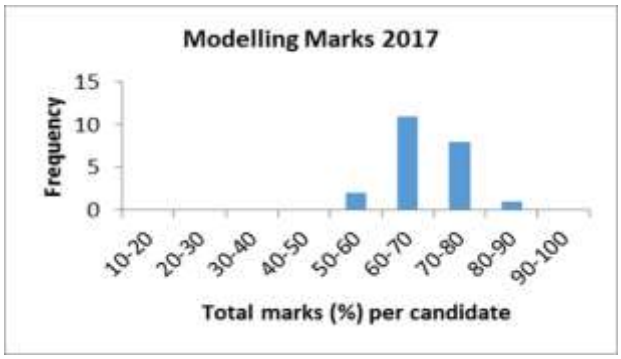


The **Industrial Visits** mark (average 91.4%) are high, as full marks can be obtained by producing a good report; the small number of reports that are only satisfactory or late are strongly penalised.

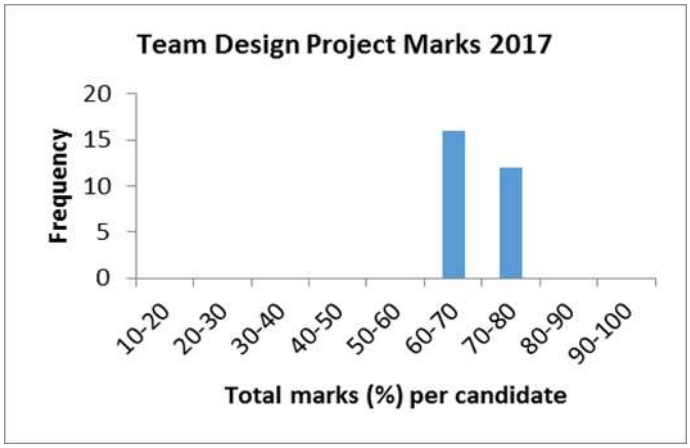



The **Advanced Characterisation** module (average 69.0%) and **Introduction to Modelling in Materials** (average 67.5%) both show a good range from lower second to goof first class; the work done has been reviewed independently by the examiners.

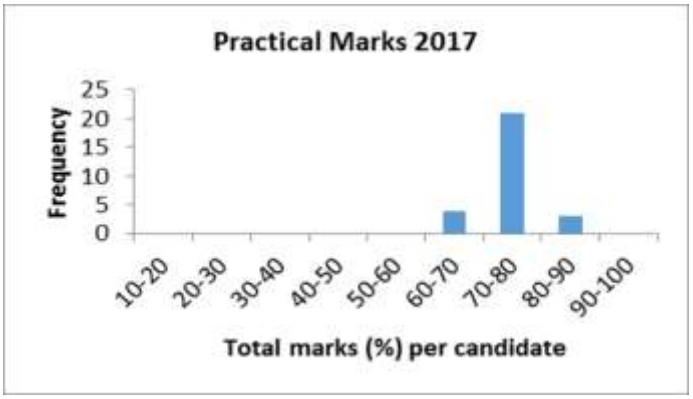



The **Team Design Project** marks (average 69.7%) show a quite narrow range, close to the upper second/first class level, which is reasonable given the sustained effort in a group task.



The marks for **Practical Classes** (average 73.8%) 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. The practical marks are quite narrowly distributed, and reflect the sustained effort and engagement by students across the practical classes and in their reporting.




| Practical No | Average Mark | Highest Mark | Lowest Mark |
|---|---|---|---|
| 2P1 | 7.61 | 9.5 | 6 |
| 2P2 | 6.46 | 7.5 | 5 |
| 2P3 | 6.38 | 9 | 4 |
| 2P4 | 7.86 | 10 | 5 |
| 2P5 | 8.38 | 9.5 | 6.5 |
| 2P6 | 7.16 | 8.5 | 5 |
| 2P7 | 8.11 | 10 | 6 |
| 2P8 | 7.54 | 9.5 | 5 |
| 2P9 | 6.55 | 7.5 | 5.5 |
| 2P10 | 7.32 | 8.5 | 6.5 |
| 2P11 | 7.54 | 10 | 5 |
| 2P12 | 6.21 | 7 | 5 |

# 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 (%) | | |
|---|---|---|---|---|---|---|
| | 2016/17 | 2015/16 | 2014/15 | 2016/17 | 2015/16 | 2014/15 |
| I | 8 | 8 | 9 | 25.0 | 34.7 | 36.0 |
| II.I | 21 | 11 | 13 | 65.63 | 47.8 | 52.0 |
| II.II | 1 | 3 | 3 | 3.1 | 13.0 | 12.0 |
| III | 1 | 0 | 0 | 3.1 | 0.0 | 0 |
| Pass | 0 | 1 | 0 | 0 | 4.3 | 0 |
| Fail | 0 | 0 | 0 | 0 | 0.0 | 0 |
| Total | 31 | 23 | 25 | - | - | - |

(2) **The use of vivas**
The Part II examination in Materials Science consists only of a research project, for which a thesis not exceeding 12,000 words, or 100 pages, is produced. The mark for the Part II is for the thesis alone. All candidates were given a viva solely to clarify points of detail and to ensure that the thesis presented had been prepared by the candidate being examined. The discussion in the vivas was led by the internal Examiners or Assessors who had read the thesis fully but the other examiners, including an external examiner, also had the opportunity to ask questions.

(3) **Marking of theses**
All theses were double blind marked by two internal Examiners or Assessors, and were inspected by one external. Due to the small 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 all the examiners. The two internal Examiners/Assessors who read the thesis provided the greatest input to the decision making process.

**B. NEW EXAMINING METHODS AND PROCEDURES**

None

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

This years' examiners (3 out of 6 of whom differ from last year) still have concerns about the FAP procedures. We consider that the current FAP process places the burden on the student to ensure the provision of all material that can be considered, including in getting other bodies (college, doctor etc.) to submit information on their behalf at a time when they are likely coping with the effects of illness or particular difficult circumstances that affect their performance to be able to do such things. This contrasts with the previous system in which further clarification or evidence could be sought if necessary. It is our view devolving decision making to the individual Examination Boards is likely to generate inconsistency in how mitigating circumstances are treated, which may in turn risk the University's reputation for fairness. A more centralised process at Divisional or University level would help achieve a consistent approach and be more in line with other institutions. The wealth of experience in dealing with mitigating circumstances accumulated over many years within the Proctors Office is not available within the individual Examination Boards. Serious consideration should be given to returning FAPs to the Proctors Office and if necessary increasing the resource available there. We recognise that the Examiners are best placed to assess how marks may be adjusted given a case, but only once a case has gone through the Proctors office to assess the validity and impact and conduct to any further enquiries.

**D. EXAMINATION CONVENTIONS**

The current year's Conventions (2017, attached) were put on the Departmental website and sent electronically to all candidates on 22 February 2017. 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 32 candidates whose results were ratified by the examiners 31 were awarded Honours (the results for one candidate are still pending). 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 55% to 85%, with an overall mean mark towards the top of the 2(i) 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, two assessors were appointed in addition to the six examiners. One assessor was unable to attend due to urgent personal circumstances that arose immediately prior to the viva sessions, but provided full reports and marks for the dissertations. A third reader was appointed to some of these to facilitate the discussion of the reports and the decision on the final marks.

**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.

[redacted]

| | Overall mark | | Part 2 Project | | Part I Mark | |
|---|---|---|---|---|---|---|
| mark (%) | Male | Female | Male | Female | Male | Female |
| 30-40 | - | - | - | - | - | - |
| 40–50 | 1 | - | - | - | 1 | 1 |
| 50–60 | 1 | 2 | 2 | 1 | 2 | 2 |
| 60–70 | 15 | 6 | 13 | 2 | 14 | 7 |
| 70–80 | 3 | 2 | 4 | 7 | 3 | - |
| 80–90 | 1 | - | 2 | - | 1 | - |
| Totals | 21 | 10 | 21 | 10 | 21 | 10 |

* [redacted]

**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 (2016) 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**

[redacted]

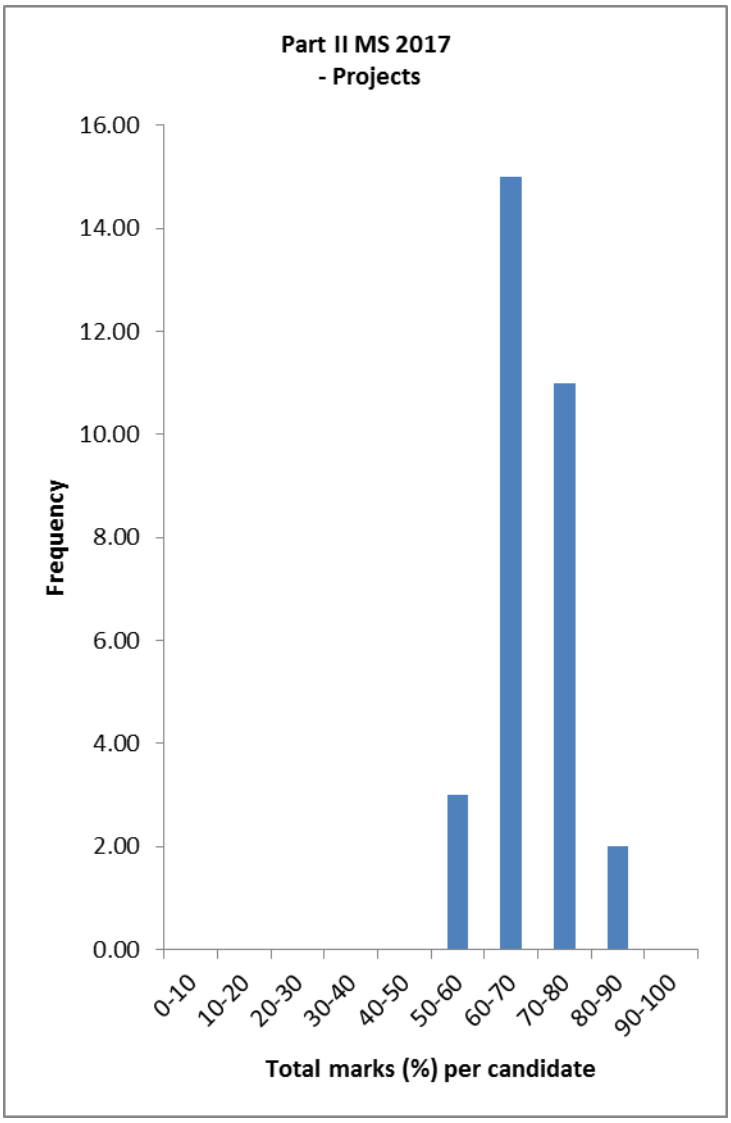
**F. NAMES OF MEMBERS OF THE BOARD OF EXAMINERS**

| | |
|---|---|
| Prof. T.J. Marrow (Chair) | Prof. P.S. Grant |
| Prof. H.E. Assender | Prof. S. Lozano-Perez |
| Prof. M.R. Castell | Prof. J.R. Yates |
| Prof. M.G. Burke (external) | Prof. M.J. Reece (external) |

## Report on Part II Projects

**Candidates:** **32**
**Mean mark:** **68.32%**
**Maximum mark:** **85%**
**Minimum mark:** **55%**

Detailed comments on the paper are as follows:



## General Comments

The majority of the part II theses were of a very high standard, engaging well with the fundamental science of the project, and some were of exceptional quality. The assessment of the theses followed closely the marking guidelines published in the Part II handbook. However, some theses were deficient in factors that are clearly identified there and all students are recommended to pay close attention to this. It was evident that some students had not allowed sufficient time for writing, reviewing and proof-reading, with parts of their thesis being less well written and presented than others. Some particular points are noted in the following.

Not all theses contained a sufficient review of the literature. This separate chapter needed to be relevant, balanced, to the point and to show critical thought (i.e. sensible discussion of previous published work); a few reviews were far too brief and cited too few references (30-50 would be low for most fields), sometimes not going far from the work of the host research group. The literature review is expected to identify the knowledge gap that the project aims to address, and some theses lacked an explicit description of the engineering or scientific context of the project, and some lacked clear statements of its aims and objectives. Most theses were well structured, and sensibly separated the Results and Discussion sections, but some provided a too shallow discussion that did not address the key results that had been obtained. Not all presented a Method section that had sufficient detail to allow a subsequent researcher to reproduce the work. Errors and reproducibility are important, both in experimental and modelling work, and were not always sufficiently addressed (and quantified where possible) where appropriate in the results and discussion section. Not all provided a clear or concise set of conclusions that could be drawn from the discussion of the results. Some paid insufficient attention to the Project Management section, and did not provide enough information on how the project was managed, nor clearly explain any changes from the original project plan.

The quality of writing and presentation was generally very good, but not all theses were sufficiently well proof-read, with common errors such as typographical and grammatical mistakes, unclear text, difficult to read figures and incorrect or incomplete referencing. The clarity of some was affected by overuse of uncommon acronyms. The quality of some theses would have been improved if there were clearer statements on what findings were new and original, and what original contributions had been made by the student during the project, such as the development of new experimental, modelling or analysis methods, design of experiments and the research programme, or new approaches and theories.

# Examination Conventions 2016/17
# Materials Science - Final Honours School

## 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 2016-17. 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 Course 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 complete model answers 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 model answers, are scrutinised by all examiners, including, in particular, 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.

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.

[1] for the 2016-17 examinations the Nominating Committee comprised Prof. Grant & Dr Taylor.

The only types of calculators that may be used in examinations are from the following series:

- CASIO fx-83
- CASIO fx-85
- SHARP EL-531

Candidates are required to clear any user-entered data or programmes from memories immediately before the exam begins. The examiners may inspect any calculator during the course of an exam.

## 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 model answers.

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 Essays*

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 the Teaching pages of the Oxford Materials website.

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

**Part II Coursework**

The Part II project is assessed by means of a thesis which is submitted 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 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 project management chapter, 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 to clarify any points the readers believe should be explored, and to ascertain the extent to which the work reported is the candidate's. An examiners' discussion is held after the viva, involving all Part II examiners, excepting any who have supervised the candidate's Part II project or are their college tutor. During this discussion 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 I Written Papers**

As the total number of students 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% or more than 75% are normally adjusted to bring the *mean* respectively up to 55% or down to 75%. Normally this is achieved by adding/subtracting the same fixed number of marks to/from each candidate's score for the paper.

b. For papers with a mean in the ranges either of 55-60% or 70-75%, 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/subtracting the same fixed number of marks to/from 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/subtracting the same fixed number of marks to/from each candidate's overall score.

**Part I Coursework**

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

The Practical Class 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.

**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*

**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 their cover sheet which questions, up to the prescribed number, they are submitting for marking. If the cover slip is not completed 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 cover slip. If the cover slip is not completed 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 work 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 work comprises a set of reports: reports on four Industrial Visits and reports on twelve Practical Classes. In these cases, a candidate must submit a report for each visit/practical in order to satisfy the examiners. Failure to complete satisfactorily the relevant element 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 Penalties for late or non-submission***

The Examination Regulations stipulate specific dates for submission of the required elements of coursework to the Examiners (1. One piece of Engineering & Society Coursework; 2. A set of twelve 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 2016/17 Regulations).

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) With permission from the Proctors under para 14.7 no penalty.

(b) With permission from the Proctors under paras 14.9 and 14.10, 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 and to any advice given in the Proctors' "Notes for the Guidance of Examiners and Chairmen of Examiners". The reduction may not take the mark below 40%.

(c) Where the candidate is not permitted by the Proctors to remain in the examination, he or she will be deemed to have failed the examination as a whole.

(d) Where, without the permission of the Proctors under paras 14.9 and 14.10, work is proffered so late that it would be impractical to accept it for assessment a mark of zero shall be recorded and, as per the Special Regulations for the Honour School of Materials Science, normally the candidate will have failed Part I or II as appropriate of the Examination as a whole.

(e) Where no work is submitted a mark of zero shall be recorded and, as per the Special Regulations for the Honour School of Materials Science, normally the candidate will have failed Part I or II as appropriate of the Examination as a whole.

Where an element of coursework 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 element of coursework in question* (i) the Examiners will award a mark of zero and (ii) dispensation will be granted from the Regulation that requires a minimum mark of 40% if the candidate is not to fail 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 2015/16 MS/MEM 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/MEM FHS Handbook (sections 7 and 10.8 of the 2015/16 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 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. 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 ).

## 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<br>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<br>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<br>50 – 59 | The candidate shows basic problem-solving skills and adequate knowledge of most of the material. |
| Class III Honours<br>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<br>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<br>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:**

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, 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 or may retake Part I the following year (subject to college approval).

*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 leave with a B.A. (without honours) or may retake Part I the following year (subject to college approval).

*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 the following year (subject to college approval).

**Part II:**

*Classified Honours* – Once marking is completed for both Parts I and II an overall percentage mark is computed for each candidate and classification then takes place. Subject to the requirement that Part II be adjudged worthy of honours (see below), 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. However, a candidate cannot be awarded an M.Eng. degree unless his/her performance in Part II is adjudged worthy of honours i.e. a candidate must be adjudged worthy of honours both in Part I and in Part II to be awarded the M.Eng. degree. Failure to achieve honours in Part II will result in the candidate leaving with an unclassified B.A. (Hons) irrespective of the aggregate mark.

*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*

The attention of candidates for Part I of the Examination is drawn to key phrases in clauses 8 and 11 of Section A and clause 3 under Part I of Section B of the Special Regulations for the Honour School of Materials Science:

> Section A. 8. 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 and (b) normally obtained a minimum mark of 50% averaged over all elements of assessment for the Part I Examination.
>
> Section A. 11. 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].
>
> Section B. Part I. 3. 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.

In Part II, a *viva voce* examination is held for all candidates: 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

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. Such a candidate may re-enter for the whole of the Part I examination on one occasion only, normally in the year 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. FACTORS AFFECTING PERFORMANCE (FAP)

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 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. Normally, this FAP meeting will take place before Part A of the meeting of the internal examiners at which the raw examination results are reviewed. When reaching these FAP meeting decisions on impact level, the internal examiners will take into consideration the severity and relevance of the circumstances, and the strength of the evidence. Examiners will also note whether all or a subset of papers were affected, being aware that it is possible for circumstances to have different levels of impact on different papers. The banding information will be used at Part B of the meeting of the internal examiners at which the raw examination results are reviewed and recommendations to the Finals Board are formulated regarding any action(s) to be taken in respect of each FAP. Further information on the procedure is provided in the *Policy and Guidance for examiners, Annex C* and information for students is provided at www.ox.ac.uk/students/academic/exams/guidance. It is very important that a candidate's FAP 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.

## 7. DETAILS OF EXAMINERS AND RULES ON COMMUNICATING WITH EXAMINERS

The Materials Science Examiners in Trinity 2017 are: Prof. Hazel Assender, Prof. Martin Castell, Prof. Patrick Grant, Prof. Sergio Lozano-Perez, Prof. James Marrow (Chair), Prof. Jonathan Yates. The external examiners are Prof. Alison Davenport, University of Birmingham, and Prof. Mike Reece, Queen Mary, University of 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.

## Annexe

**Summary of maximum marks available to be awarded for different components of the MS Final Examination in 2017 (For Part I and Part II students who embarked on the FHS respectively in 2015/16 and 2014/15)**

| | 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)

In their 3rd year, a candidate may opt to transfer out of the M.Eng. programme and seek to exit with a classified B.A. award, via one of the following routes:

- Route 1 – Transfer to the B.A. at the start of the 3rd year
- Route 2 – Transfer to the B.A. at the end of the 3rd year

**Route 1**

Such a candidate will have studied a reduced subset of Options courses and undertaken an additional element of coursework, comprising a literature-based research module. In this case, the candidate will sit the same Option papers as all other Part I candidates but for each paper will answer only two questions in a reduced timeframe of 1.5 hours. The maximum number of marks available on each option paper is 50, and questions carry equal marks. The literature-based research module will be assessed by means of an extended essay of up to 4,000 words which is submitted to the examiners, who will also take into account a written report from the candidate's academic advisor for this research module. The essay is double marked, blind, by two examiners and allocated a maximum of 50 marks.

**Route 2**

Such a candidate will have completed the same elements of assessment as for Part I of the M.Eng. and in addition will be required to undertake a literature-based research module during the Long Vacation following the written papers. Consideration of all the results will be made by the examiners in the Trinity term of the year following the written papers. The literature-based research module will be assessed by means of an extended essay of up to 4,000 words which is submitted to the examiners, who will also take into account a written report from the candidate's academic advisor for this research module. The essay is double marked, blind, by two examiners and allocated a maximum of 50 marks.

The examiners will apply to the extended essay the conventions detailed above in relation to:

- Short-weight and departure from rubric
- Late or non-submission
- Over-length work and departure from approved titles or subject-matter

The examiners will apply the conventions that relate to the M.Eng. as detailed above to all other elements of assessment for the B.A.

The qualitative descriptors of classes given in Section 4.1 also apply to the B.A.

Once marking is completed an overall percentage mark is computed for each candidate and classification then takes place. Subject to being adjudged worthy of honours, classification is based solely on the overall percentage mark; the candidate's profile of marks from each element of assessment is taken into account only in borderline cases.

*Classified Honours* – To be adjudged worthy of Honours normally a candidate must obtain a minimum mark of 40% averaged over all elements of assessment, obtain a minimum mark of 40% in each of at least four of the six written papers, and satisfy the coursework requirements.

*Pass* – The examiners consider that the candidate's overall performance has reached an adequate standard but is not worthy of Honours. The candidate is listed as a Pass on the class list and is awarded a B.A. (without honours).

*Fail* – The examiners consider that the candidate's overall performance is not worthy of a B.A.

In the event that a candidate obtains a mark of less than 40% averaged over all elements of assessment, or if a candidate fails to satisfy the examiners, a **resit** is permitted. Such a candidate may re-enter for the whole of the examination on one occasion only, normally in the year following the examiners' original decision. The examination will be identical to that taken by the other B.A. candidates in said academic year. If such a candidate is adjudged worthy of honours, as defined under 'Classified Honours' above, the examiners may award a 3rd class Honours classification. The Examiners shall be entitled to award a Pass to a candidate who has reached a standard considered adequate but who has not been adjudged worthy of Honours on the occasion of this resit.

**Summary of maximum marks available to be awarded for different components of the MS Final Examination in the B.A. (Hons) exit award in 2017**

Route 1

| | Component | Mark |
|---|---|---|
| **Part I** | General Paper 1 | 100 |
| | General Paper 2 | 100 |
| | General Paper 3 | 100 |
| | General Paper 4 | 100 |
| | Materials Options Paper 1 | 50 |
| | Materials Options Paper 2 | 50 |
| | Practicals | 60 |
| | Industrial visits | 20 |
| | Engineering and Society coursework | 20 |
| | Team Design Project | 50 |
| | Characterisation or Modelling module | 50 |
| | Literature-based research module | 50 |
| **Overall Total** | | **750** |

Route 2

| | 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 |
| | Literature-based research module | 50 |
| **Overall Total** | | **850** |

# REPORT ON FINAL HONOURS SCHOOL OF MATERIALS ECONOMICS AND MANAGEMENT, PART I EXAMINATION

**Part I**

## A. STATISTICS

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

The Part I Examination in Materials Economics and Management is unclassified. No distinctions are awarded. Since the number of candidates in this year and previous years is fewer than six, numerical data are confidential.

| Category | Number | | | Percentage | | |
|---|---|---|---|---|---|---|
| | 2016/17 | 2015/16 | 2014/15 | 2016/17 | 2015/16 | 2014/15 |
| Distinction | n/a | n/a | n/a | n/a | n/a | n/a |
| Pass | n/a | n/a | n/a | n/a | n/a | n/a |
| Fail | n/a | n/a | n/a | n/a | n/a | n/a |

(2) **The use of vivas**

As stated in the Examination Conventions, vivas are no longer used in the Part I examination.

(3) **Marking of scripts**

All scripts were double-blind marked by the Examiners. The full procedures are described in the Examination Conventions.

## B. NEW EXAMINING METHODS AND PROCEDURES

None

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

This years' examiners (3 out of 6 of whom differ from last year) still have concerns about the FAP procedures. We consider that the current FAP process places the burden on the student to ensure the provision of all material that can be considered, including in getting other bodies (college, doctor etc.) to submit information on their behalf at a time when they are likely coping with the effects of illness or particular difficult circumstances that affect their performance to be able to do such things. This contrasts with the previous system in which further clarification or evidence could be sought if necessary. It is our view devolving decision making to the individual Examination Boards is likely to generate inconsistency in how mitigating circumstances are treated, which may in turn risk the University's reputation for fairness. A more centralised process at Divisional or University level would help achieve a consistent approach and be more in line with other institutions. The wealth of experience in dealing with mitigating circumstances accumulated over many years within the Proctors Office is not available within the individual Examination Boards. Serious consideration should be given to returning FAPs to the Proctors Office and if necessary increasing the resource available there. We recognise that the Examiners are best placed to assess how marks may be adjusted given a case, but only once a case has gone through the Proctors office to assess the validity and impact and conduct to any further enquiries.

## D. EXAMINATION CONVENTIONS

The current year's Conventions were put on the Departmental website and sent electronically, along with other information in a letter from the Chair of Examiners to all candidates, on 22 February 2017. 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 three candidates for the examination. The examination consisted of seven written papers plus coursework that included a team design project, industrial visit reports and practical work carried out during the 2nd and 3rd year. One of the written papers (Introductory Economics) is taken in the 2nd year.

The written papers consisted of four Materials papers, two Economics papers and one Management paper, each of which lasted three hours. For the Materials papers, candidates were required to answer five questions out of eight, as in previous years. The Economics and Management Examiners followed their usual procedures.

Team design projects were marked by two Examiners. Teams were marked as groups containing MS and MEM students. The allocation of bonus or penalty marks is permitted under the Conventions, but this was not applied by the examiners this year.

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

All MS and MEM general papers results were considered by the examiners and it was agreed that the papers were fair.

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

There were three candidates: two female and one male. With these small numbers, the breakdown of the results is confidential (see Section E).

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

All candidates took the same papers for the whole examination.

## 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

[redacted]

[redacted]

**F. NAMES OF MEMBERS OF THE BOARD OF EXAMINERS**

Prof. T.J. Marrow (Chair)
Prof. H.E. Assender
Prof. M.R. Castell
Prof. P.S. Grant
Prof. S. Lozano-Perez
Prof. J.R. Yates
Dr. K. Okamura (Management)
Prof. T. Powell (Management)
Dr S.G.B. Cowan (Economics)

Prof. A.J. Davenport (External)
Prof. M.J. Reece (External)
Prof. B. MacCarthy (External, Management)
Prof. A. Banerjee (External, Economics)

## General Paper 1 – Structure and Transformations

See report under Materials Science Part I

## General Paper 2 – Electronic Properties of Materials

See report under Materials Science Part I

## General Paper 3 – Mechanical Properties

See report under Materials Science Part I

## General Paper 4 – Engineering Applications of Materials

See report under Materials Science Part I

## Coursework:

A maximum of 120 marks are available for Part I coursework which comprises:

- Y2/3 Industrial Visit Reports – 20 marks
- Y2/3 Practical Lab Reports – 50 marks
- Y3 Team Design Projects – 50 marks

See report under Materials Science Part I

# Examiners' Report for MEM Part I 2016 – Economics Papers

## Report on Introductory Economics (June 2016)

1. This question was reasonably competently done on average but there was a certain amount of dispersion in the quality of answers. Parts (f) and (g) differentiated very good answers from the rest. Candidates should be encouraged to (i) draw their diagrams accurately and to label them fully as marks were lost unnecessarily for this in this question (ii) to read the question carefully; the fact that it is stated that there are no income effects for one of the goods is a very useful piece of information for answering the parts on welfare measurement and also drawing the indifference curve map correctly, and (iii) to annotate their mathematical work indicating what they are doing – this makes it possible for examiners to award marks even if there is an algebraic error.

2. The mechanical/computational aspects of this question were well answered in general. The only errors candidates made were to confuse their units and so produced answers which were out by an order of magnitude. Candidates answering questions like this in the future would be well advised to denominate quantities and nominal values in some simple units like billions and write, for example, £6.5bn and to use £'s per billion as the price rather than to use many zeros or powers of ten.

3. This question was answered accurately by most candidates. Some of the same general comments for Question 1 also apply here: candidates should ensure that they (i) draw their diagrams accurately and to label them fully as marks were lost unnecessarily for this in this question and (ii) annotate their mathematical work indicating what they are doing – this makes it possible for examiners to award marks even if there is an algebraic error. Part (g) differentiated candidates – the best answers were numerically accurate but also supported by clear, concise explanations.

4. This question was generally well answered. Candidates were adept at calculating equilibrium unemployment rates for different settings for the job finding rate and job separation rate and at evaluating unemployment changes out of equilibrium. Explanations and interpretations of model results were sometimes less good, for example some candidates attributed equilibrium unemployment to distortions of the steady-state arising from minimum wage laws rather than citing churning in the market and the kinds of frictions that prevent the unemployed from immediately matching with a new employer.

5. Candidates showed good knowledge of how to set up the Solow equilibrium and could explain how convergence to steady-state occurs. Candidates were also able to derive mathematical expressions for the equilibrium capital/labour ratio and the equilibrium real wage. Explanations of the impact of technology changes on real wages generally fell short – candidates correctly predicted that improvements to technology would boost real wages but failed to see the second round effects of improved technology on capital accumulation and hence the marginal product of labour and the real wage. The final part of the question proved to be a good discriminator – many candidates predicted that labour flows from Turkey to Germany would eventually eliminate real wage differences between the countries, but in fact that extra supply of labour in Germany only temporarily reduces real wages since a thinning of the capital/labour intensity creates pressure for capital accumulation that forces German real wages higher again. In the limit and all else equal all workers would relocate from Turkey to Germany.

6. For this question candidates were able to use the IS-MP-PC model to work out the effects of a fiscal shock. For the first part on tax cuts some candidates failed to see the relevance of Ricardian Equivalence. In the open economy extension of the model few candidates discussed how the slope of IS and the required magnitude of real interest rate changes would be different in an open economy. For the final part, definitions of the real exchange rate were often quite poor and some candidates attributed real exchange rate changes to appreciation of the nominal exchange rate, which was fixed in the description of the final part of the question.

7. Many students opted to illustrate their answer by running through the Cournot oligopoly model. This was reasonably sensible and typically the model was recounted accurately, but few candidates who took this route explained the sources and nature of the inefficiency in the Cournot model clearly, and so their answers were less good than they otherwise might have been. Surprisingly, a few candidates failed to explain the standard Prisoners' Dilemma accurately.

8. There were few answers to this question.

9. This question invited a discussion of the costs of fixed exchange rate systems with particular reference to the Classical Gold Standard and the post-WWII Bretton Woods system. The very best answers clearly set out the open economy monetary trilemma and argued that the Gold Standard had capital mobility and exchange rate pegs so that the cost of the peg was a loss of monetary autonomy, while the Bretton Woods system allowed a degree of policy autonomy under fixed rates through limiting capital mobility, and then provided a discussion of how a loss of either policy autonomy or capital mobility was inefficient.

10.
11. This question asked for a discussion of the consumption effects of a new ISA scheme and its likely impact on house prices and rents. Answers to this essay were less good. Most candidates asserted an incentive to save more under the new ISA scheme but attempts to show how the marginal rate of transformation changes in the 2 period consumption diagram were often inaccurate. Similarly, whilst most candidates could see a positive effect of the scheme on housing demand and house prices, the link between house prices and rents was not well explained and some candidates asserted that as house prices rose rents would fall.

Two hundred and seventy-two candidates sat the paper: 154 PPE candidates, 86 E&M, 15 H&E, and 17 across EEM & MEM. This was second year of the new exam format in which all questions in Part A were compulsory; again, there were four questions of unequal weights. About a dozen candidates breezed through these short questions and got pretty much everything correct, receiving an average over 80%; about 30 candidates messed up or failed to answer two or more short questions and, with no compensating marks elsewhere in Part A, had an average mark below 40%; the marks of the remaining candidates were fairly uniformly distributed between 40% and 80%.

Distribution of attempts at questions (Part B only):

| Question | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|
| Attempts | 6% | 18% | 70% | 18% | 34% | 55% |

*Comments on Individual Questions*

Part A

1] *General Equilibrium* (ave. 70%)
(b) Alarmingly, a lot of candidates could not define a general competitive equilibrium.
(c) Quite a few candidates (even good ones) did not read all the question: "Derive … and its level of profits …". Independently, many candidates forgot to include the firm's profit in the consumer's budget (although this does not affect the marginal decision).

2] *IO (Mergers)* (ave. 55%)
Some candidates fell at the first hurdle, unable to get beyond 'monopolies are welfare reducing'. Some stated that increased profits *could* outweigh reduced consumer surplus. And some remembered that a large reduction in costs could mean that the new (monopoly) price falls below the old (duopoly) marginal cost-pricing.
Quite a few mentioned that R&D might benefit consumers in the long-run, but that was not needed (or expected) in order to secure full marks.
(Surprisingly many ignored the hint to use a diagram.)

3] *Risk & Expected Utility* (ave. 65%)
(a) This part (on coefficients of risk aversion) tended to be graded 0% or 100%.
(b) A few struggled with the certainty equivalent and the risk premium, but a large majority got this right.
(c) One popular (but wrong) answer was 1/2, the spread of one lottery being half that of the other. Another less popular (and wrong) answer was 1, because S&J had

the same initial wealth and attitude to risk. Many candidates reached the correct answer of 1/4 but for a wrong reason, e.g. something to do with the exponent of 1/2 in the utility function. Surprisingly few got this part right for the right reason (risk premium is approx. $\frac{1}{2}A(w)\sigma^2$).

4] *Signalling* (ave. 60%)
(a) Generally, correct or mostly correct.
(b) Too many ignored the ratio of types being 1:2 and used a ratio of 1:1. Also, the answer to "what is the market equilibrium outcome?" is not the bald "200", but something like "all workers employed, wage is 200".
(c) Some students just don't get it: when testing for an equilibrium, no agent can unilaterally choose to deviate to another *equilibrium* (that would involve other agents also deviating). And some students have a very loose notion of 'efficiency'.

Part B

As can be seen from the table on the previous page, most candidates tackled Q7 &/or Q9 &/or Q10. (That makes ~190 essays on 'collusion' and ~90 on 'insurance'. Yawn.)

5] *Trade* (ave. 65%, medium spread)
Not a popular question. Heavy use was made of standard lecture material for the first few parts. Some candidates then began to struggle with "How is your answer modified …?" The last part (on Brexit) seemed to be an opportunity to waffle &/or air firmly held prejudices.

6] *Social Choice* (ave. 59%, small spread)
Not a very popular question. Some (or all) of 'Pareto (incomplete ranking)', 'social welfare functions', 'Impossibility theorem', 'single-peaked preferences', 'median voter' were mentioned but rarely developed. The last part ("Can it be used in practice to evaluate …?") was very poorly addressed.

7] *IO (collusion)* (ave. 64%, small spread)
The 'safe' choice. The first question (looking at it from the firm's viewpoint) was by and large answered well, higher marks being awarded to answers that were well put together and not simple regurgitations, although most of even the better essays omitted some of the subtleties. The answers to the second question (from the view-point of the anti-trust authorities) were more uniform, but often focussed on 'ban mergers' or 'manipulate the discount rate or rate of time preference' (somehow).

8] *Expected Utility Theory* (ave. 61%, medium spread)
Not a very popular question. Candidates listed or mentioned the underlying assumptions and axioms, almost always omitting one or two. Some had a much better understanding than others of what the Expected Utility Theorem actually is,

namely a representation theorem. Some paradoxes were noted, but few discussed the descriptive *vs* prescriptive topic, or for which economics agents EU theory might be more appropriate.

9] *Insurance (& Screening)* (ave. 62%, medium spread)
Rather popular question. There were many good attempts at the first part of the question, although some candidates lost their way towards the end of their analysis. For the second part of the question, candidates presented detail & summary of the standard Rothschild-Stiglitz model of competitive provision of insurance – as is common, these answers ranged from very good to those showing scant knowledge. The standard of the sketches illustrating indifference curves in state-contingent income space along with various policies that firms might offer was typically poor (as usual).

10] (ave. 66%, large spread)
The long problem was again popular this year with just over half of the PPE candidates and two thirds of the E&M candidates attempting it. As usual, the variance in the marks for this question was high, but the high mean indicates that candidates found the problem less difficult than the examiners expected. One quibble the assessors had is that many candidates failed to be clear and precise about what constitutes a contract: when effort is observable it is $(e, w)$, an effort-wage pair; when effort is unobservable it is $(w_1, w_2)$, a list of wages contingent on output. In part (c), the better answers made explicit reference back to part (b) in order to explain why it legitimate for the principal to ignore the possibility that the agent might choose $e_M$.

# Examiners' Report for MEM Part I 2017 – Management Papers

## General Management
## First Public Examination, Trinity 2017

**General overview**

**The overall standard of scripts was good, with most scripts reaching 2i standard, and a fair number achieving a higher standard. In general, students were expected to:**

1. **Reproduce a tutorial essay related to the examination question, without actually answering the examination question set;**

2. **Answer the question using material drawn from one or more tutorial essays and material from the lectures, other readings, and outside evidence:**

3. **Provide evidence of individual critique, synthesis, extension, or deeper consideration of the issues being discussed.**

**At the top end, candidates produced clear, insightful and comprehensive answers to essay questions, showing evidence of wide reading across the syllabus, independent thought and critical analysis. First-class answers were organised into a clear, coherent structure, and were supported with references to readings on and outside the reading list, good examples and/or illustrations, including original examples. Part B, which may have been problematic for at least some students, was dropped this year, which may have helped the distribution of marks at the high end, given that more students were able to answer four questions consistently.**

**As ever, the examinations showed evidence of the majority for the candidates' having extensive knowledge, ability to work under time pressure, and keeping cool under pressure (and very hot temperatures). Students showed evidence of having paid attention to the learning goals stated in the reading list, which provided explicit guidance in terms of the expected breadth and depth in which the material should be mastered.**

**Weaker answers listed key points from various readings and/or the lectures, were only tangentially related to the examination questions, and failed to construct an argument addressing the question or quotation. This includes the dubious reuse of examples (or occasionally readings) from different contexts where their relevance was unclear. Some weaker scripts still had only one or two strong answers suggesting that those students may have been economical with their revision and unprepared for questions across the syllabus.**

**A concerning number of students still reproduced tutorial essays rather than focussing on the exact terms of the question, or only answered part of the question, having read it incorrectly or ignored an essential element. Past assessors' reports have frequently commented on this as an issue, particularly the failure to pay close attention to the exact question set, and a tendency instead to repeat well-rehearsed points relevant to the topic in general terms. Some very weak answers reproduced the learning objectives more or less verbatim but failed to produce arguments, support points, provide examples and illustrations, etc. Candidates and tutors should be mindful that the examination rubric provides a step mark of 55 (2ii) for "*a well-constructed essay that fails to address the question asked*."**

**Very occasionally candidates tried to bluff their way through answers with various on-the-spot inventions of fact or argument. More than one author would have been very surprised at the material attributed to them, including the course lecturers. Astonishing facts that were learnt from the examination included the use of Frederick Taylor (b. 1856) in the mid-19$^{th}$ century; Henry Ford as (simply) a factory manager; and firms employing more than one person not**

**having come into existence until the near present (despite our discussion of the evolution of modern capitalism, Josiah Wedgwood's Etruria factory, Adam Smith, etc.)**

**Detailed Comments on Questions**

**Compared with previous years, there was a much more even spread of choice of questions, although Q1 (theory of the firm) and Q10 (branding) were not surprisingly the most popular, and Q11 (operations management) and Q12 (operations management) the least popular. This more even distribution may also be related to the demise of Part B.**

**I have listed the principal weeks and learning objectives to which each question most obviously relates, but students were not penalised for showing knowledge across more than one week's material where it is relevant to answering the questions, or for answering from a different week if the answer fit the question.**

**Q1. Transactions costs (Answered by 48)**

**This question mainly related to *MT Week 1. Introduction: From the Growth of Modern Capitalism to the Rise of the Modern Corporation* and the Week 1 learning outcome: "Compare and contrast theoretical frameworks such as Chandler's three-pronged investment strategies and transaction cost economics."**

**Students generally did a reasonable job of identifying the concept of the "modern industrial corporation" and of identifying Chandler's three-pronged approach. Better answers gave some attention to explaining how transaction cost describes not only the existence of the firm, but also the specific structure of the modern industrial corporation (and specifically the M-form corporation). Best answers also identified critiques and shortcomings of both theoretical frameworks in explaining the evolution of the modern industrial corporation. Some students took "modern industrial corporation" to mean any contemporary business. Whilst some students did a good job showing how recent changes in transaction costs had encouraged the replacement of vertical integration with outsourcing, it was not essential to answering the question.**

**Q2. Direct workers (Answered by 33)**

**This question mainly related to *MT Week 2. The Development of Managerial Hierarchy: From Industrial Management to HRM,* and to the Week 2 learning objective: "Critically evaluate the extent to which [Taylor and Ford's] ideas are relevant today, drawing upon more recent work by theorists, considering the impact of changes in the economic environment in recent decades, and exploring debates on the application of Taylorist/Fordist principles to the service sector and e-services, as well as the Japanese approach to mass-production." Students were generally capable of giving a good account of Taylorism and Fordism, although occasionally at too much length, and of the growth of HRM. Many students drew on Barley and Kunda effectively. Some students were confused by the term "direct worker", taking it to mean any employee of the organisation, and in particular top managers and CEOs.**

**Q3. External environments (Answered by 35)**

**This question mainly related to *MT Week 3. Technological Innovation and Change: From Creative Destruction to Social Construction,* and the learning objective: "Explain how technological innovation and change shape organisations internally and externally, and how these shape strategy and competition;", and to *Week 4. Evolution: From Organisations to Organising,* and in particular the learning objective: "Explain the influence of factors other than process technology on organisations and organisation design." A number of students drew on organisational theory, including contingency theory, population ecology, and institutional**

**theory, and some made good arguments as to whether firms adapted to or were shaped by external environments. A number of answers focused mainly on competitive environments and strategy, although structure and culture were alternate foci (some good answers showed the interrelation with the external environment), as was theory of the firm. It might be noted that the overall framing device for weeks 1-4 was "*Organisations and External Environments*". Surprisingly few answers mentioned the role of technology in shaping firms, for example Schumpeter's "creative destruction" and other theories of technology as an exogeneous and teleological force, but some answers made good use of this material.**

**Q4. Strategy (Answered by 38)**

**This question related mainly to *MT Week 5. Competitive Strategy: Industry Analysis versus Resources and Capabilities*, and to the learning objective: Provide a balanced discussion of the different models of competitive strategy, including the ideas of Michael Porter and the concepts of core competence and resource-based view, and provide satisfactory critiques and analysis of these models, together with *Week 6. Corporate Strategy: Design versus Practice,* and the learning objectives "describe the debate between the planning and learning schools, comparing and contrasting Mintzberg's emergent and Ansoff's deliberative views of strategy; and explain whether, how and why flexibility might be built-into strategy, drawing on say the resource-based view and notions of core and dynamic capabilities, and where the balance might lie in terms of the impact on organizational performance between flexibility and rigidity", and "provide a wide-ranging discussion of strategy, drawing upon Whittington's typology of approaches". Although this was a very popular question, somewhat disappointingly most students simply reproduced large sections of the tutorial essays from the two weeks rather than considering the examination question, although a few provided nuanced discussions of the "has" versus "does".**

**Question 5. CEO Pay (Answered by 24).**

**This question related mainly to *MT Week 7.Corporate Governance: Stakeholders vs Top Management Teams* and to the learning objective: "Provide a critical perspective on CEO compensation, showing an awareness of the complex trade-offs which have to be dealt with when designing a compensation scheme for CEOs, drawing from different schools of thought as well as the finance literature". Most students were able to describe the principal-agent problem, and different mechanisms for rewarding top executives and setting top management compensation. A number of students focused on the difficulty of measuring performance, and the issue of "fairness" to the top manager. Some students also described the role of shareholders, and relatively few discussed the wider set of stakeholders (as highlighted in the week's lecture title) with an interest in CEO pay.**

**Question 6. Home Country (Answered by 19).**

**This question related mainly to *MT Week 8. International Business: Global Markets vs Global Corporations*, and to the learning objective: "Explain how institutions and politics can be important for the conduct of international business, being able to critically evaluate the concept of corporate social responsibility and employ key tools for resolving questions of business ethics in an international context." Students brought together a variety of factors from the effect of national culture on organisational culture (e.g., Hofstede) to comparative systems of capitalism and corporate governance, with some drawing on the frameworks and ideas presented in the MT.8 lecture.**

**Question 7. Transformational Change (Answered by 26)**

**This question related mainly to *HT Week 1. Managers as Leaders (1): Organisational Culture and Change* and to the learning objective: "Explain the difficulties and pitfalls of managing**

**organisational change, and some strategies for successful change". Most students were able to explain why organisational transformations threaten firm survival. Better answers discussed why it is so hard to achieve successful organisational changes such as mergers/acquisitions or expansion into new markets and what can managers do to improve the chances of success;**

**Question 8. Power and Decision making (Answered by 26)**

**This question related mainly to *HT Week 2.Managers as Leaders (2): Power and Decision-making*, and to the learning objective: critically analyse decision-making more generally. A good answer to this question provided an overview of influential models of decision-making that explain how decisions get made in organisations; considered what determines the distribution of power within organisations and the circumstances under which conflict might be expected to break out in an organisation; and described obstacles to successful organisational decision-making, biases in organisational decision-making and barriers to decisions being enacted. Some students used this question to discuss either strategic management or corporate governance, which, whilst not outside the scope of the question, did ignore the material directly relating to the topic in the lecture and reading list.**

**Question 9. Effect of the Internet (Answered by 33)**

**This question related mainly to *HT Week 4. Managing Markets: Marketing and Marketing Strategy* and the learning objective "Discuss changes in approaches to marketing and explore the implications of these developments for the skills and traits needed by marketers today". Students were generally very good at describing the internet and its effect on marketing strategy, and at talking about recent development such celebrity marketing and social media. A surprising number chose to ignore the final word "function" in the question, however, and ignored the implications for marketers' skills and traits, although the ones who engaged with it often provided good insights.**

**Question 10. Brands and Reputation (Answered by 46)**

**This question mainly related to HT Week 6. Managing Consumers: Consumer Behaviour and Consumption, and to the learning objective: "Discuss the nature and creation of brands, distinguish between brands and reputations, and discuss the relationship between the two". Unfortunately, quite a few students simply reproduced essay content on branding and consumer culture theory (CCT) without actually answering the final element of the question, "21st century firms". Some focused on the role of brands in antiquity through Veblen's (1899) "conspicuous consumption", leading to the speculation that they took 21st century to comprise the 1900s.**

**Question 11. Production systems (Answered by 12)**

**This question related mainly to *HT Week 6: Managing operations: Manufacturing and the supply chain,* and to the teaching objective, "Focus on the evolution over time of "best practices" in operations management, especially in high-performance manufacturing systems, including just-in-time/lean production". Although relatively few students answered this questions, they generally showed good command of the key principles of Just-in-Time and mass production (also covered in MT), and there were a few outstanding answers that showed deep understanding of the two.**

**Question 12. Operational Efficiency (Answered by 4)**

**This question related mainly to *HT Week 7: Managing operations: Services and operational improvement* and to the teaching objective "Understand the main features of service-based organizations", although some students gave good answers based on the material in the**

**previous week on manufacturing and supply chains. This was answered by the fewest students. There were a few good answers drawing on service operations and the work of Ted Levitt, for example.**

# REPORT ON FINAL HONOURS SCHOOL OF MATERIALS ECONOMICS AND MANAGEMENT, 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. Since the number of candidates is fewer than six, numerical data are confidential (see section E, below).

| Class | Number | | | Percentage (%) | | |
|---|---|---|---|---|---|---|
| | 2016/17 | 2015/16 | 2014/15 | 2016/17 | 2015/16 | 2014/15 |
| I | n/a | n/a | n/a | n/a | n/a | n/a |
| II.I | n/a | n/a | n/a | n/a | n/a | n/a |
| II.II | n/a | n/a | n/a | n/a | n/a | n/a |
| III | n/a | n/a | n/a | n/a | n/a | n/a |
| Pass | n/a | n/a | n/a | n/a | n/a | n/a |
| Fail | n/a | n/a | n/a | n/a | n/a | n/a |
| Total | 1 | 2 | 3 | - | - | - |

(2) **The use of vivas**
Vivas were not used for this 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**

None

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

This years' examiners (3 out of 6 of whom differ from last year) still have concerns about the FAP procedures. We consider that the current FAP process places the burden on the student to ensure the provision of all material that can be considered, including in getting other bodies (college, doctor etc.) to submit information on their behalf at a time when they are likely coping with the effects of illness or particular difficult circumstances that affect their performance to be able to do such things. This contrasts with the previous system in which further clarification or evidence could be sought if necessary. It is our view devolving decision making to the individual Examination Boards is likely to generate inconsistency in how mitigating circumstances are treated, which may in turn risk the University's reputation for fairness. A more centralised process at Divisional or University level would help achieve a consistent approach and be more in line with other institutions. The wealth of experience in dealing with mitigating circumstances accumulated over many years within the Proctors Office is not available within the individual Examination Boards. Serious consideration should be given to returning FAPs to the Proctors Office and if necessary increasing the resource available there. We recognise that the Examiners are best placed to assess how marks may be adjusted given a case, but only once a case has gone through the Proctors office to assess the validity and impact and conduct to any further enquiries.

**D. EXAMINATION CONVENTIONS**

The current year's Conventions were put on the Departmental website and sent electronically, along with other information in a letter from the Chair of Examiners to all candidates, on 22 February 2017. 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 was one candidate for the examination. The examination consisted of two written papers, one being a compulsory Materials Options paper, and the other paper being selected from a range of Economics and Management options. For the Materials Options paper, candidates were offered twelve questions in six 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.
In addition to the written papers, candidates are required to submit a report on a 24-week industrial placement, which has the weight of two written papers. The reports on these 24-week Management projects are marked by staff at the Said Business School. For reasons of anonymity, the details of the overall mean marks are discussed in Section E, below.

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

Due to the small number of candidates for this examination, the numerical data are confidential (see section E, below).

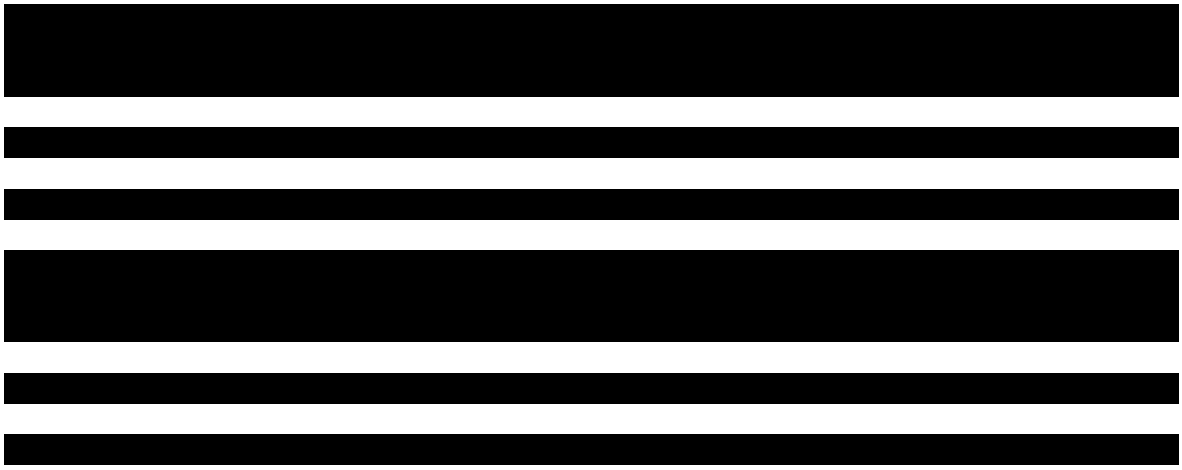
## C. DETAILED NUMBERS ON CANDIDATES' PERFORMANCE IN EACH PART OF THE EXAMINATION

Due to the small number of candidates numerical data are confidential (see section E, below).

## 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



## F. NAMES OF MEMBERS OF THE BOARD OF EXAMINERS

Prof. T.J. Marrow (Chair)
Prof. H.E. Assender
Prof. M.R. Castell
Prof. P.S. Grant
Prof. S. Lozano-Perez.
Prof. J.R. Yates
Dr. C.D. McKenna (Management)
Prof. T. Powell (Management)
Dr S.G.B. Cowan (Economics)

Prof. A.J. Davenport (External)
Prof. M.J. Reece (External)
Prof. B. MacCarthy (External, Management)
Prof. A. Banerjee (External, Economics)

## Materials Options Paper 2

See report under Materials Science Part I

# Examiners' Report for MEM Part II 2017 – Economics Papers

## Written Papers

37 scripts have been marked. Marks ranged from 33% to 85%; the overall average was 64.3%, the standard deviation about 10.6%. There were 13 first-class, 12 upper-second, 9 lower-second class scripts, also two marks in the 40's and one in the 30's. Four out of eight questions had to be answered (at least one from Part A and one from Part B); each had an equal weight. Marks for each question are reported below on a 0-100% scale for convenience.

Question 1: 34 candidates attempted it for an average of almost 69% with a standard deviation of 11%. Most candidates correctly identified strategies surviving iterated dominance and also the unique (mixed) Nash equilibrium. Providing an exact definition for rationalizability was the key to part (b). In part (d) only few candidates found a correlated equilibrium that induces the same distribution over final outcomes as independent mixing does in Nash.

Question 2: 19 attempts, average mark 59%, standard deviation 21% (quite large). Typical mistakes included computing best-responses either from an ex-ante perspective (before types are realized), or by implicitly assuming symmetric information — even though this Bayesian game had incomplete information, so type-dependent strategies were allowed, and a firm's payoff had to be computed conditional on its type. In part (a) the key observation was that inefficient firms never invest, whereas efficient firms would like to invest slightly more than their opponent.

Question 3: 11 attempts, average mark 75%, standard deviation 12%. Most of those who attempted this question on voting games clearly knew how to solve it.

Question 4: 14 attempts, average mark 57%, standard deviation 16%. This was a dynamic game with incomplete information; the key to a high score was to think carefully (and describe) out-of-equilibrium beliefs.

Question 5: 12 attempts, average mark 57%, standard deviation 12%. Part (a) went reasonably well. In part (b) several alternative answers were accepted — ones that identified the ESS as if the game were symmetric, or discussed conditional ESS. Most candidates attempting this question found part (d) very difficult.

Question 6: 21 attempts, average 60%, standard deviation 9%. Most candidates answered part (a) correctly but found later parts more difficult. A common mistake was to omit the description of out-of-equilibrium play (responses to offers off the equilibrium path).

Question 7: only one solutions, which was quite weak (45%).

Question 8: All but one candidate answered this question, the average was 68% the standard deviation 15%. Only the best solutions noted the range (continuum) of Nash equilibria in which Player 1 plays a pure strategy and Player 2 mixes. One of these equilibria (where Player 2's mixing is "as extreme as possible", found by several candidates, even those who missed the whole range) is rather convenient for constructing punishment phases because it induces minmax payoffs. In part (c) some candidates confused subgame perfection with renegotiation proofness, but overall the question went quite well, as the average mark suggests.

# Examiners' Report for MEM Part II 2017 – Management Papers

No Management papers were selected by the 2017 MEM Part II candidate from the suite of Economics & Management options

**Management Project**

No report is produced

# Examination Conventions 2016/17
# Materials, Economics and Management - Final Honours School

## 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, Economics & Management for the academic year 2016-17. The E(M)EM Standing Committee 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 Course 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 E(M)EM Standing Committee, the Academic Committee in the Department of Materials, the Mathematical, Physical and Life Sciences Division, the Social Sciences Division, the Education Committee of the University and the Proctors who may offer advice or make recommendations to examiners.

The Materials examiners are nominated by the Nominating Committee[2] of the Department of Materials 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 of Materials, the colleges and of those who teach the MEM M.Eng. programme. However, for written papers on Materials Science examiners are expected to consult with course lecturers in the process of setting questions.

## 2. RUBRICS AND STRUCTURE FOR INDIVIDUAL PAPERS

Part I candidates take four compulsory Materials papers (General Papers 1 – 4); one compulsory Economics paper; and one compulsory Management paper.

Part II candidates take one compulsory Materials Options paper and one paper from a range of Management and Economics options.

**Materials Papers:**

Part I General Papers 1 – 4 are set by the Materials 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. The Materials Options paper in Part II is set by lecturers of the option courses and two examiners, the examiners acting as checkers.

The Materials examiners, in consultation with lecturers, produce complete model answers 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 model answers, are scrutinised by all examiners, including, in particular, the external examiners. The marking schemes are approved by the examining board alongside the papers.

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

[2] for the 2016-17 examinations the Nominating Committee comprised Prof. Grant & Dr Taylor.

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.

The Materials Option paper comprises 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 the 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.

For the Materials papers in Part I and Part II, the only types of calculators that may be used in examinations are from the following series:

- CASIO fx-83
- CASIO fx-85
- SHARP EL-531

Candidates are required to clear any user-entered data or programmes from memories immediately before the exam begins. The examiners may inspect any calculator during the course of an exam.

**Economics and Management papers**:

Below are the links to both subjects' WebLearn sites where further details relating to individual papers can be found:

Economics
Management

The Economics and Management papers are set by examiners nominated respectively by the Economics Faculty and the Saïd Business School. Candidates are advised to read particularly carefully the specific instructions on the front of each paper as to the number of questions they should submit, since the rubrics on Economics and Management papers differ slightly from those for the Materials papers.

MEM candidates sit the compulsory Ec1: Introductory Economics paper in Trinity Term of their 2nd year. This paper will be set and examined as for all other Part I and Part II Economics papers and contributes to the Part I mark. The marks for this paper will be formally ratified by the Board of examiners for Part I examinations held in the Trinity Term following that in which the Ec1 paper is sat.

## 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*

For the Materials assessments, 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. |

*For Economics and Management papers, please refer* to both subjects' WebLearn sites where further details relating to individual papers can be found:

Economics
Management

***3.3 Verification and reconciliation of marks***

**Materials Written Papers:**

During the marking process the scripts of all written papers remain anonymous to the markers. The markers are guided by the model answers.

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.

The Materials Options paper is marked by course lecturers acting as assessors and a Materials examiner acting as a checker.

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

***Economics & Management Written Papers:***

*Please refer* to both subjects' WebLearn sites where further details relating to individual papers can be found:

Economics
Management

**Materials 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.

(6) *Practicals*

Practicals are assessed continually by senior demonstrators in the teaching laboratory and in total are allocated a maximum of 50 marks. Part I examiners have the authority to set a practical examination.

(7) *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.

(8) *Team Design Project*

The team design project is double marked, blind, by two of the Part I Materials 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 the Teaching pages of the Oxford Materials website.

(9) *4th Year Management Project*

The management project is allocated a maximum of 200 marks and is marked by the Saïd Business School.

The projects are assessed and graded independently by two Assessors. The supervisor's comments on the performance of the candidate are provided to the Assessors. The marks provided by the Assessors are moderated by an Examiner, and the final mark is ratified by the Board of Examiners.

The process is:

- Supervisors provide a report on the performance of the student, indicating any special circumstances that could have affected the student's performance on the project and report preparation.
- The project reports are graded blind by two Assessors, taking account of the Supervisor's comments. At least one of the Assessors will have knowledge of the area of the project.
- The Supervisor's report, and Assessors' reports and marks are provided to an Examiner, who moderates the marks and provides a final mark for ratification by the Board of Examiners.
- Supervisors may not act as Assessor or Examiner for a project they have supervised.

An Assessor may also act as Examiner for a project. The Assessor should assess and mark the report before having sight of the other Assessor's report and marks.

### *3.4 Scaling*

**Written Papers**

As the total number of MEM students 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.

Materials Papers:

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'. The normal procedure for 'scaling' of the Materials written papers will be as follows:

a. Papers with a *mean taken over all candidates* of less than 55% or more than 75% are normally adjusted to bring the *mean* respectively up to 55% or down to 75%. Normally this is achieved by adding/subtracting the same fixed number of marks to/from each candidate's score for the paper.

b. For papers with a mean in the ranges either of 55-60% or 70-75%, 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/subtracting the same fixed number of marks to/from 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/subtracting the same fixed number of marks to/from each candidate's overall score.

Economics and Management Papers:

*Please refer* to both subjects' WebLearn sites where further details relating to individual papers can be found:

Economics
Management

Where a paper has been taken by both MEM and EEM students normally the decision will be informed by the mean and the distribution of marks taken over all EEM & MEM candidates for that paper. In deciding what 'scaling', if any, to apply normally the examiners will take into account the following additional information:

(a) For each paper, comments from the MEM examiners representing the Economics or Management Faculty as appropriate
(b) A report by the Chairman of Examiners on any scaling adopted by the EEM examiners
(c) The performance of the MEM cohort and the MEM+EEM cohort on the other Economics and Management papers
(d) The performance of the MEM cohort on the Materials papers

**Materials Coursework**

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

The Practical Class 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***

***Materials 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 their cover sheet which questions, up to the prescribed number, they are submitting for marking. If the cover slip is not completed 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 cover slip. If the cover slip is not completed then the examiners will mark the sections in alphabetical order by section delineator (section A, section B, etc.).

**Economics and Management Written Papers:**

Please refer to both subjects' WebLearn sites where further details relating to individual papers can be found:

Economics
Management

**Materials Part I Coursework**

It is a requirement for candidates to submit an element of work for each of the following: Practical Classes; Industrial Visits; Team Design Project. For the Practical Classes and Industrial Visits, the element of work comprises a set of reports: reports on four Industrial Visits and reports on twelve Practical Classes. In these cases, a candidate must submit a report for each visit/practical in order to satisfy the examiners. Failure to complete satisfactorily the relevant element 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 Penalties for late or non-submission***

The Examination Regulations stipulate specific dates for submission of the required elements of coursework to the Examiners (1. A set of nine 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.); 2. A Team Design Project Report and associated oral presentation; 3. A set of four Industrial Visit Reports as specified in the course handbook; and 4. A Part II Management Project). Rules governing late submission of these four 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 2016/17 Regulations).

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

(a) With permission from the Proctors under para 14.7 no penalty.

(b) With permission from the Proctors under paras 14.9 and 14.10, 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 and to any advice given in the Proctors' "Notes for the Guidance of Examiners and Chairmen of Examiners". The reduction may not take the mark below 40%.

(c) Where the candidate is not permitted by the Proctors to remain in the examination, he or she will be deemed to have failed the examination as a whole.

(d) Where, without the permission of the Proctors under paras 14.9 and 14.10, work is proffered so late that it would be impractical to accept it for assessment a mark of zero shall be recorded and, as per the Special Regulations for the Honour School of Materials, Economics and Management, normally the candidate will have failed Part I or II as appropriate of the Examination as a whole.

(e) Where no work is submitted a mark of zero shall be recorded and, as per the Special Regulations for the Honour School of Materials, Economics and Management, normally the candidate will have failed Part I or II as appropriate of the Examination as a whole.

Where an element of coursework 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 element of coursework in question* (i) the Examiners will award a mark of zero and (ii) dispensation will be granted from the

Regulation that requires a minimum mark of 40% if the candidate is not to fail 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 2015/16 MS/MEM 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, Economics and Management are set out in the MS/MEM FHS Handbook (sections 7 and 10.8 of the 2015/16 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, Economics and Management 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 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. 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 ).

## 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<br>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<br>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<br>50 – 59 | The candidate shows basic problem-solving skills and adequate knowledge of most of the material. |
| Class III Honours<br>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<br>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<br>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:**

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.

Candidates adjudged worthy of honours 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.

*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 leave with a B.A. (without honours) or may retake Part I the following year (subject to college approval).

*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 the following year (subject to college approval).

**Part II:**

*Classified Honours* – Once marking is completed for both Parts I and II an overall percentage mark is computed for each candidate and classification then takes place. Subject to the requirement that Part II be adjudged worthy of honours (see below), 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. However, a candidate cannot be awarded an M.Eng. degree unless his/her performance in Part II is adjudged worthy of honours i.e. a candidate must be adjudged worthy of honours both in Part I and in Part II to be awarded the M.Eng. degree. Failure to achieve honours in Part II will result in the candidate leaving with an unclassified B.A. (Hons) irrespective of the aggregate mark.

*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*

The attention of candidates for Part I of the Examination is drawn to key phrases in clauses 6 and 7 of Section A and clause 3 under Part I of Section B of the Special Regulations for the Honour School of Materials, Economics and Management:

> Section A. 6. ...no candidate may present him or herself for examination in Part II unless he or she has been adjudged worthy of Honours by the Examiners in Part I.
>
> Section A. 7. 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].
>
> Section B. Part I. 3. 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 three

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 either Part I or Part II of the examination.

## 5. RESITS

In Part I, a candidate who obtains only a pass, or if a candidate fails to satisfy the examiners, a resit is permitted. Such a candidate may re-enter for the whole of the Part I examination on one occasion only, normally in the year 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 in Part I, the candidate may progress to Part II.

Part II may be entered on one occasion only.

## 6. FACTORS AFFECTING PERFORMANCE (FAP)

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 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. Normally, this FAP meeting will take place before Part A of the meeting of the internal examiners at which the raw examination results are reviewed. When reaching these FAP meeting decisions on impact level, the internal examiners will take into consideration the severity and relevance of the circumstances, and the strength of the evidence. Examiners will also note whether all or a subset of papers were affected, being aware that it is possible for circumstances to have different levels of impact on different papers. The banding information will be used at Part B of the meeting of the internal examiners at which the raw examination results are reviewed and recommendations to the Finals Board are formulated regarding any action(s) to be taken in respect of each FAP. Further information on the procedure is provided in the *Policy and Guidance for examiners, Annex C* and information for students is provided at www.ox.ac.uk/students/academic/exams/guidance. It is very important that a candidate's FAP 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.

## 7. DETAILS OF EXAMINERS AND RULES ON COMMUNICATING WITH EXAMINERS

The Materials, Economics and Management Examiners in Trinity 2017 are: Prof. Hazel Assender, Prof. Martin Castell, Prof. Patrick Grant, Prof. Sergio Lozano-Perez, Prof. James Marrow (Chair), Prof. Jonathan Yates (examiners from the Department of Materials); Dr Simon Cowan (examiner from the Department of Economics); and Dr Ken Okamura, Prof. Thomas Powell (examiners from the Saïd Business School). The external examiners are Prof. Alison Davenport (Materials, University of Birmingham), Prof. Mike Reece (Materials, Queen Mary, University of London), Prof. Anindya Banerjee (Economics, University of Essex) and Prof. Bart MacCarthy (Management, Nottingham University Business School).

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.

## Annexe

**Summary of maximum marks available to be awarded for different components of the MS Final Examination in 2017 (For Part I and Part II students who embarked on the FHS respectively in 2016/17 and 2015/16)**

| | Component | Mark |
|---|---|---|
| **Part I** | General Paper 1 | 100 |
| | General Paper 2 | 100 |
| | General Paper 3 | 100 |
| | General Paper 4 | 100 |
| | Introductory Economics (Ec1) | 100 |
| | General Management | 100 |
| | Microeconomics | 100 |
| | Practicals | 50 |
| | Industrial visits | 20 |
| | Team Design Project | 50 |
| *Part I Total* | | *820* |
| **Part II** | Management Project | 200 |
| | Materials Options Paper 2 | 100 |
| | One paper from a choice of Economics and Management Papers. | 100 |
| *Part II Total* | | *400* |
| *Overall Total* | | *1220* |

## Reports from the External Examiners for Materials

| | | |
|---|---|---|
| **Title of Examination(s):** | | Materials Science |
| **External Examiner Details** | **Title:** | Professor |
| | **Name:** | Alison Davenport |
| | **Position:** | Head of the School of Metallurgy and Materials |
| | **Home Institution:** | University of Birmingham |

***Please complete both Parts A and B.***

**Part A**

| | *Please (✓) as applicable** | **Yes** | **No** | **N/A / Other** |
|---|---|---|---|---|
| A1. | Did you receive sufficient information and evidence in a timely manner to be able to carry out the role of External Examiner effectively? | ✓ | | |
| A2. | Are the academic standards and the achievements of students comparable with those in other UK higher education institutions of which you have experience? | ✓ | | |
| A3. | Do the threshold standards for the programme appropriately reflect the frameworks for higher education qualifications and any applicable subject benchmark statement?<br>*[Please refer to paragraph 3(b) of the Guidelines for External Examiner Reports].* | ✓ | | |
| A4. | Does the assessment process measure student achievement rigorously and fairly against the intended outcomes of the programme(s)? | ✓ | | |
| A5. | Is the assessment process conducted in line with the University's policies and regulations? | ✓ | | |
| 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, please provide further comments in 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?*

***High academic standards were achieved by most students in their project reports and vivas, examination scripts, laboratory reports and other forms of continuous assessment. These standards compare very well with those in other Universities offering similar degree programmes.***

b. *Please comment on student performance and achievement across the relevant programmes or parts of programmes (those examining in joint schools are particularly asked to comment on their subject in relation to the whole award).*

***Apart from a very small number of exceptions, students performed well across both the Materials Science MEng course (the majority of the students) and the Materials Economics and Management Programme (few students). There were some excellent project reports and vivas and examination papers, and a very small number of failed modules. The breadth and depth of the courses were particularly impressive.***

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 very rigorous and fair. I was given ample opportunity to comment on the papers in advance, and received very satisfactory comments in response to points raised.***

***The double marking process was particularly thorough, and was presented in a way that was very clear and easy to understand. I took a detailed look at the marking for students who had failed modules, and was able to establish that the marks given were well-justified.***

***While one or two papers had averages that were close to the limits generally used, no scaling was applied. I took a look at these papers, and regarded this decision as a reasonable one.***

***The viva process was particularly thorough, and the performance of the students was generally very impressive. It was noted that as student numbers are increasing, it may be difficult to continue the process in its current form.***

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 are no issues of significant concern.***

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.*

***Overall, the research opportunities provided in the projects were outstanding. A number were at or close to the standard expected for first year PhD students, and provided excellent training in research methods.***

***The structure of project reports was somewhat variable, and in some cases deviated significantly from the standard format found in journal papers and PhD theses. While there were a number of outstanding theses, some students were not particularly effective in articulating the novelty of their findings in the context of the literature in their discussion section and conclusions. Furthermore, the "engineering context" of the project was more commonly mentioned in the introduction to the project rather than considering the engineering implications of project findings. There may be some merit in students receiving more detailed instructions as a cohort on how to present projects.***

***A number of students clearly benefited greatly from carrying out their projects in MIT. However, there appeared to be some variability in the degree of co-ordination between MIT and Oxford supervisors, which could perhaps benefit from closer monitoring.***

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.*

***The examination process was very effective and all of the paperwork was exceptionally clearly presented.***

| | |
|---|---|
| Signature: |  |
| Date: | 17.07.17 |

**Please email your completed form (preferably as a word document attachment) to: external-examiners@admin.ox.ac.uk and copied to the applicable divisional contact.**

**Alternatively, please return a copy by post to: The Vice-Chancellor c/o Catherine Whalley, Head of Education Planning & Quality Review, Education Policy Support, University Offices, Wellington Square, Oxford OX1 2JD.**

| | | |
|---|---|---|
| **Title of Examination(s):** | | Materials Science |
| **External Examiner Details** | **Title:** | Prof |
| | **Name:** | Mike Reece |
| | **Position:** | |
| | **Home Institution:** | Queen Mary University of London |

***Please complete both Parts A and B.***

| **Part A** | | | | |
|---|---|---|---|---|
| | *Please (✓) as applicable** | **Yes** | **No** | **N/A / Other** |
| A1. | Did you receive sufficient information and evidence in a timely manner to be able to carry out the role of External Examiner effectively? | ✓ | | |
| A2. | Are the academic standards and the achievements of students comparable with those in other UK higher education institutions of which you have experience? | ✓ | | |
| A3. | Do the threshold standards for the programme appropriately reflect the frameworks for higher education qualifications and any applicable subject benchmark statement?<br>*[Please refer to paragraph 3(b) of the Guidelines for External Examiner Reports].* | ✓ | | |
| A4. | Does the assessment process measure student achievement rigorously and fairly against the intended outcomes of the programme(s)? | ✓ | | |
| A5. | Is the assessment process conducted in line with the University's policies and regulations? | ✓ | | |
| 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, please provide further comments in 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 majority of the students demonstrated high academic standards as evidenced by their coursework (broad range of activities), examination scripts, project reports and vivas. They compare very favourably with other institutes.***

b. *Please comment on student performance and achievement across the relevant programmes or parts of programmes (those examining in joint schools are particularly asked to comment on their subject in relation to the whole award).*

***The majority of the students were on the Materials Meng programme. There were a few students on the Materials Economics and Management Programme. The marks for the students on both programmes were good. There were only a few failures of specific exam papers. [redacted]. I sat in on 15 Part II vivas. I was very impressed by the standard of most of the students. They gave a good impression of being ready to start productive careers in industry and academia.***

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 examination process from the writing of the papers through to the final exam board was thoroughly and fairly run. The papers were well written and challenging. The averages for the exams were within a reasonable band, except for GP3 (Mechanical Properties of Materials), which had an average of 75%. I did comment on the draft examination paper that I thought that this paper was noticeably easier than the other papers. The average for this examination in previous years was more reasonable, and this was probably a one off. No scaling was applied to any marks this year.***

***I checked the five failed exam scripts in Part I. The first and second marking was rigorous and fair.***

***Again, I was very impressed by the rigour of the assessment of the part II reports and the conduct of the part II vivas. The vivas lasted for 35 mins, which with the current cohort meant three continuous days of vivas. This was hard work for the exam board members because they had to sit through them all. It was not so bad for the external examiners because the task was split. With increasing numbers of students it may not be possible to continue with the current arrangement, which would be a shame. The Department will now consider the best option for the future.***

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 commented last year on the unsatisfactory handling by the University of extenuating circumstances. Last year they were discussed at the final exam board meeting. This year there was a pre-meeting of the exam board to consider and discuss these. Their recommendations were simply read out at the final exam board meeting. From the point of an external examiner this is a much better arrangement, and I suggest that you stick with it. What I can not comment on is whether at the pre-meeting the information they had to make their decisions was sufficient and timely.***

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 programmes are well tried and tested and deliver an excellent education. As I have commented in previous years, the Part II projects provide the students with excellent research training and experience.***

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.*

***The exam process ran very smoothly. From the point of view of an external examiner, everything is run very clearly and well. The scripts, reports, and coursework are very nicely organised to make our work easier.***

| | |
|---|---|
| Signature: |  |
| Date: | 02.07.17 |

**Please email your completed form (preferably as a word document attachment) to: external-examiners@admin.ox.ac.uk and copied to the applicable divisional contact. Alternatively, please return a copy by post to: The Vice-Chancellor c/o Catherine Whalley, Head of Education Planning & Quality Review, Education Policy Support, University Offices, Wellington Square, Oxford OX1 2JD.**

**Faculty of Materials**

# Department of Materials Academic Committee

## RESPONSE TO EXAMINERS' REPORTS 2017

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

***Honour School of Materials, Economics & Management (MEM) Parts I & II – Materials elements only, main response will be made by the E(M)EM Standing Committee***

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

### 1. Summary of major points

There were no major issues arising from the 2017 Examinations.

However there was continuing concern among the Materials internal examiners over the new arrangements for dealing with Factors Affecting Performance; in particular the onus placed on the student, who by definition is not at 100% fitness, to appropriately evidence their FAP application. The Chairman's report for the MS Part I summarises the concerns very clearly.

### 2. Points for inclusion in Responses to the External Examiners

**MS & MEM Parts I & II: Professor A. Davenport**

We thank Professor Davenport for her very positive report 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.

Professor Davenport suggested we encourage greater consistency in writing style and structure of the Part II theses, for example to norms in research thesis presentation, and noted variability in articulating the scientific and engineering context in terms of the engineering implications of the project findings. The former will be addressed through changes in the guidance to students, supervisors and examiners, and improvement is also likely as a result of our new policy to include a more detailed generic report on the strengths and weaknesses of the Part II theses in the detailed examiners' reports that are made available to our students and staff. The latter will be addressed both by means of improved guidance and indirectly through the new support we are developing on engineering ethics and related topics.

For the external projects, carried out at MIT, Professor Davenport also sensed some variability in the degree of coordination between MIT & Oxford supervisors. The Part II Organiser is drawing up further guidance on the department's expectations of Part II supervisors, including the Oxford supervisor of an externally based Part II student, and for the external projects will monitor the extent of supervision proactively.

**MS & MEM Parts I & II: Professor M.J. Reece**

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

The Department was pleased to note that, from the perspective of an external examiner and proceedings at the Final Board, Professor Reece felt that the FAP procedures were handled in a more effective manner this year.

**MEM Parts I & II, Management Papers: Professor B. MacCarthy**

We thank Professor MacCarthy for his positive report and for his careful scrutiny of scripts, and share his regret over the phasing-out of the MEM programme.

**MEM Parts I & II, Economics Papers: Professor A. Banerjee**

We thank Professor Banerjee for his positive report and for his careful scrutiny of scripts. We note his comment about the value of providing a more detailed breakdown of marks to the external examiner – for the Materials papers taken by MEM students such information is made available to our external examiners.

## 3. Further Points

The suggestions of the Chair of Prelims in terms of question setting were discussed in detail at a meeting of the Department's Academic Committee (DMAC) and at the 'handover' meeting between incoming and outgoing Chairs of Prelims, the Chairman of DMAC and the Academic Administrator. It was concluded that an important step will be for the Prelims examiners to ensure they review the draft questions and model answers provided by the lecturers on a timeline that leaves the Chair plenty of time to follow up with the lecturers if the examiners require more information in order to set a balanced and suitably differentiating paper.

Follow up on the high average for the Prelims Crystallography coursework has determined that neither the difficulty of the classwork questions (and the rigour in the associated marking) nor the way that the classes are conducted has changed. It would seem that the 2017 cohort simply engaged very effectively with this coursework. Noting also that a significant revision to the Prelims classes is in the pipeline no action will be taken 2017/18.

## 4. Examination Conventions

We confirm that when updating our Examination Conventions we consider the points in the Guidance on Examination Conventions issued by the MPLS Division.

A.O. Taylor, Chairman of DMAC, 22/12/17

**E(M)EM Standing Committee**

**Reports from the External Examiners for the Economics & Management Components of MEM Part I & II**

| | | |
|---|---|---|
| **External examiner name:** | Anindya Banerjee | |
| **External examiner home institution:** | University of Birmingham | |
| **Course examined:** | Materials, Economics and Management | |
| **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? | X | | |
| 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].* | X | | |
| A3. | Does the assessment process measure student achievement rigorously and fairly against the intended outcomes of the programme(s)? | X | | |
| A4. | Is the assessment process conducted in line with the University's policies and regulations? | X | | |
| A5. | Did you receive sufficient information and evidence in a timely manner to be able to carry out the role of External Examiner effectively? | X | | |
| A6. | Did you receive a written response to your previous report? | | | x |
| A7. | Are you satisfied that comments in your previous report have been properly considered, and where applicable, acted upon? | | | x |
| * ***If you answer "No" to any question, please provide further comments in 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 compare very favourably with those in other higher education institutions. The questions on the papers I evaluated were rigorous and the process of marking and assessment fair.

b. *Please comment on student performance and achievement across the relevant programmes or parts of programmes (those examining in joint schools are particularly asked to comment on their subject in relation to the whole award).*

I only had the opportunity to examine the written economics exams for MEM. The students appear to have achieved a good standard with the marks attained in the low to mid-sixties on average. This is somewhat lower than they appear to have attained in their Engineering components in particular but this is only to be expected.

### 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.*

No comments except to say that all aspects of the process were undertaken carefully.

### 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?*

It would have been helpful to have received a spreadsheet containing the marks of all the students across the questions in the scripts instead of just an aggregate mark per script. Some comments or annotations on why a particular mark on a paper was awarded would also have helped. This being the penultimate year of this particular degree means my remark has low specific relevance but it would be helpful as a general point for exam boards across the university could take into account.

### 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.*

No specific information on which to base such comments.

**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.*

None.

| | |
|---|---|
| **Signed:** | Anindya Banerjee |
| **Date:** | 3 July 2017 |

**EXTERNAL EXAMINER REPORT FORM 2017**

| | | |
|---|---|---|
| **External examiner name:** | Professor Bart MacCarthy | |
| **External examiner home institution:** | University of Nottingham, Business School. | |
| **Course examined:** | Economics and Management;<br>Engineering, Economics & Management;<br>Materials, Economics & Management. | |
| **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, please provide further comments in 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 standards achieved by students are comparable with the top-tier universities in the UK. The breadth of topics on which students are examined (and on which many excel) is impressive.

b. *Please comment on student performance and achievement across the relevant programmes or parts of programmes (those examining in joint schools are particularly asked to comment on their subject in relation to the whole award).*

In general students on the Economics and Management programme performed very well with a relatively high proportion of firsts. Notwithstanding, I was happy that students merited the awards made based on their performance across a demanding set of papers. Only a small number of candidates were examined for the joint Engineering, Economics & Management and Materials, Economics & Management. Their performance appeared to be similar to the main cohort. It is a pity that these innovative joint courses are being discontinued.

### 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.*

Great care and attention to detail were demonstrated in the assessment processes. The pre-Board meeting had looked at any anomalies in marks awarded and had identified specific issues for the External Examiners to consider. Full consideration was given to students with extenuating circumstances that could have affected performance and I felt that appropriate decisions were made in all these cases. The formal Exam Board reviewed the recommended awards thoroughly and gave detailed consideration to borderline cases. An issue had arisen with one of the papers taken by a large number of candidates. I was particularly impressed at the level of scrutiny and pre-consultation given by the Chief Examiner in dealing with the issue in order to ensure fairness and equitable treatment for all candidates who took the paper. Problems do arise in university assessment processes from time to time. When they do it is important that they are dealt with appropriately. The attention given to this issue in this case was commendable.

### 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?*

None.

**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.*

Students are exposed to an impressively wide range of relevant cases and reading across most of the modules taken and this is to be encouraged.

**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.*

The introduction of a final year dissertation in lieu of one or more taught modules might be considered in the future for the Economics and Management programme. Although it can raise significant issues in terms of supervision load, it can also enhance a student's overall undergraduate educational experience. An approach used in some places is to ask interested students to write a proposal for a research topic - only those students with well-crafted proposals for which there is appropriate supervision available are offered the opportunity to undertake a dissertation. This might be done at the end of the second year.

| | |
|---|---|
| **Signed:** | B L MacCarthy |
| **Date:** | 14/8/2017 |

## Extract from the UNCONFIRMED Minutes of the discussion of Examiners' Reports at the EMEM Standing Committee held on 26th October 2017

### STANDING COMMITTEE FOR E(M)EM

### Part II - Reserved

### 7. Examiners' Reports

### 7.1. Chairman's Report for EEM Part C

The Standing Committee received the Chairman's Report for EEM Part C: no matters of concern were raised.

### 7.2. Chairman's Report for MEM Parts I & II

The Standing Committee received the Chairman's Report for MEM Parts I & II: no matters of concern specific to MEM were raised.

### 7.3. External Examiners' Reports

The external examiners' reports were received from:

- Engineering: Professors Augarde, Doufexi and Jobson
- Economics: Professor Banerjee
- Management: Professor MacCarthy
- Materials: Professors Davenport and Reece

The Standing Committee was pleased to note the overall complimentary nature of the comments from the external examiners.

(To be confirmed at the HT18 meeting of the E(M)EM Standing Committee on 1st February 2018)