CONFIDENTIAL

EXAMINERS' REPORTS 2014

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

Internal Examiners' Reports Page

REPORT ON PRELIMINARY EXAMINATION IN MATERIAL SCIENCE

Part I

A. STATISTICS

Category	Number			Percentage		
	2013/14	2012/13	2011/12	2013/14	2012/13	2011/12
Distinction	10	10	6	30	29	23
Pass	18	21	20	55	62	77
Fail	5	3*	0	15	9	0

* Passed the resit in September

Marking of scripts

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

B. NEW EXAMINING METHODS AND PROCEDURES

This year, the course lecturers suggested questions, with supporting model answers.

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.

MS2 clearly suffers from candidates dropping certain topics. This has impact for FHS and Faculty should consider ways to address this.

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

33 students were registered for the examination.

26 candidates passed all papers, without the necessity for compensation; 2 candidates were awarded a compensated pass (in MS3). Of the total of 28 successful candidates in June, 10 were awarded Distinctions, all with marks of 72% or more (rounded). This relatively high number of distinctions reflected what the Moderators saw as a strong set of scripts. On the other hand, although the number of students who passed is in line with previous years, this year there was a higher number of students who failed, 5.

The prize for the best overall performance in Prelims was awarded to Takashi Lawson, of St Edmund Hall. The prize for the best performance in 1st year Practicals was awarded to Stephen Turrell of St Catherine's College. Additional prizes for outstanding performance were awarded to Lev Chechik of Mansfield College and Xiewen Liu, of St Catherine's College.

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

Where approved by the Proctors, 4 candidates were allowed (i) extra time on account of dyslexia / dyspraxia, and/or (ii) other special arrangements. These allowances seemed satisfactory.

Gender Issues:

Of the 33 candidates 7 were women and 26 men.

1 of the 10 distinctions was 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 65.3 and for females 62.9.

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

Five medical certificates were received and considered by the Moderators when reviewing the final results (all related to missed practicals or delayed submission of coursework); as all candidates had passed the Preliminary Examination, no further adjustment was necessary.

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[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

F. NAMES OF MEMBERS OF THE BOARD OF EXAMINERS

Professor M.L. Galano
Professor N. Grobert
Professor J.H. Warner
Professor J.R. Yates (Chairman)

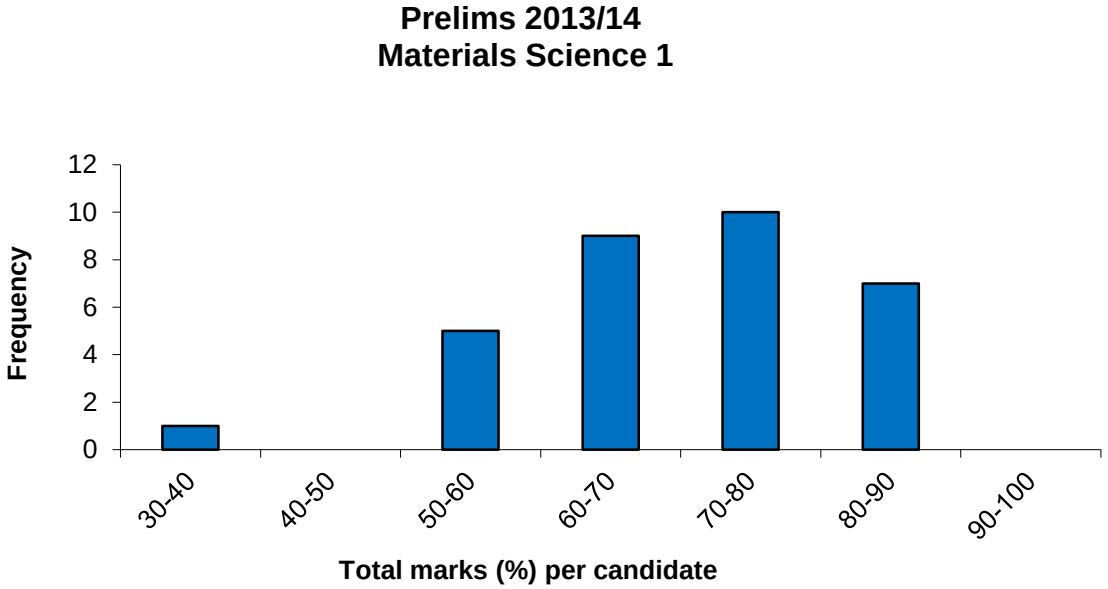
Attachments: Examination Conventions 2013/14
Comments on Materials Science 1: Structure of Materials
Comments on Materials Science 2: Properties of Materials
Comments on Materials Science 3: Transforming Materials
Comments on Maths for Materials and Earth Scientists

MS1 – Structure of Materials

Examiner: **Professor Nicole Grobert**
Candidates: **33**
Mean mark: **68.91%**
Maximum mark: **88%**
Minimum mark: **20%**

Detailed comments on the paper are as follows:

Question	No of Answers	Average Mark	Highest Mark	Lowest Mark
1	10	9.70	15	4
2	12	10.92	15	3
3	21	11.52	19	2
4	30	15.80	20	10
5	32	14.63	19	2
6	28	14.75	20	4
7	6	11.83	15	9
8	26	14.54	20	3



General comments:

1. Question 1 and 2 were reasonably popular with 10 and 12 attempts respectively. Both questions were related to crystallography. Although the questions were not too complex the average marks were just under 10 and 11. All of the students struggled to identify the symmetry elements of the P21/m space group with 3 out of possible points being the highest score for Question 1b. None of the students answered Question 2d) correctly and the majority of students struggled with Question 2c), *e.g.* only 2 candidates obtained full marks.

2. Question 3, was selected by 20 students who achieved an average mark of 11.52. While there is no clear trend the students found it challenging to generate a clear diagram for the Huygens construction. Overall the marks are quite spread. While some students found parts of the question harder than other students did they then dealt relatively well with those parts that the other students did not solve correctly. There is was clear trend that could be identified. While none of the students achieved full marks for question 3, it was the question that received the lowest (2) of the lowest marks of all questions.

3. Question 4 was the second most favourite question. 30 students worked on this question and the average mark (15.80) was the highest of all questions and so was the lowest mark with 10. Almost all candidates described interstitial solution, substitution solid solution, superlattice structure (question 4a), and stated the Hume Rothery Rules correctly (question 4b) correctly except for a handful of candidates who were not accurate enough in their description. The lowest mark for 4a) was 3.

4. Question 5 was selected by 32 students and hence was the most favourite of all eight questions. The average mark was 14.63 and only 6 candidates scored below 14 points. The students were asked to explain the different types of bonding found in MgO and Mg which most of them explained well. Some of the students however struggled to sketch the crystal structure of MgO and came up with rather unusual drawings. Question 4 and 8 were the only two questions where students achieved full marks and question 4 was the only question with the lowest mark reaching two digits (10).

5. Question 6 was amongst the top four popular questions with 28 takers and the average mark ranked well within the four highest average mark questions (14.75). The question focused on plastic deformation of metals and the students were asked to explain the concepts and differences of relevant mechanisms *e.g.* screw versus edge dislocation. The students were also asked to list and explain techniques that can be used to identify the location of dislocations and most of the students were able to list the techniques, but explanations were relatively brief, sometimes too brief.

6. Question 7 with only 9 attempts was the least favourite question and the average mark was 11.83. It was surprising that none of the students had a clear understanding of how carbon fibres are made, what types of structures exist and how this influences their properties. Question 7b) was the main reason for the average mark to be this low for a relatively easy question. The maximum score was 2 out of 6 available points for 7b).

7. Question 8 was selected 27 times and the candidates achieved an average mark of 14.54. Interestingly, only one third was able to sketch molecular orbitals for O_2 and N_2 correctly. The rest of the candidates did not seem to have a very clear picture of MOs and came up with some imaginative sketches.

Summary:

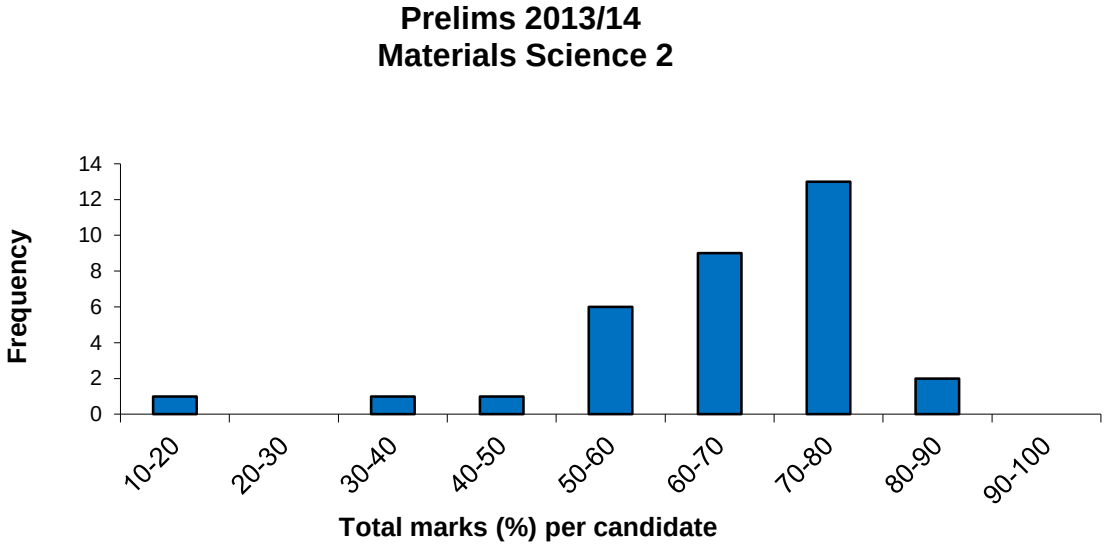
As in previous years, a general preference for questions who involved explaining and describing as opposed to analytically solving or calculating could be observed. Crystallography questions did not score very well and indicate a worrying lack of knowledge in the area by most of the students who chose to answer the questions in the exam. In addition, the quality of the handwriting of the majority of the students is appalling and made it difficult to identify relevant content. [redacted]. Moreover, 16 students did not follow the instructions of the coversheets and used one booklet for more than one question. Some also included two separate questions on the same page, some students did not number their questions or numbered them wrongly, one student wrote the name of the cover sheet and crossed it out, and one student did not identify the questions answered on the cover sheet, but attempted more than 8 questions.

MS2 – Properties of Materials

Examiner(s): **Professor Jamie Warner**
Candidates: **33**
Mean mark: **65.48%**
Maximum mark: **87%**
Minimum mark: **15%**

Detailed comments on the paper are as follows:

Question	No of Answers	Average Mark	Highest Mark	Lowest Mark
1	29	14.41	18	7
2	33	12.58	17	2
3	5	10.00	16	4
4	31	13.71	20	8
5	30	12.97	17	9
6	6	15.00	19	4
7	7	12.29	17	6
8	22	13.09	19	1



General Comments

1. **Elasticity and Structure:** This was a popular question with a high average mark. The question required knowledge of shear force and bending moment diagrams. Most students completed parts of each component of the question.

2. **Elasticity and Structure:** This was the most popular question, but had a relatively low average mark compared to most of the other questions. The question required knowledge of transformation of axes resolving strain to an inclined axis, Mohr's circle for strain and principal strains.

3. **Elasticity and Structure**: This was the most unpopular question with the lowest average mark. The question required sketching the energy variation as a function of distance for two atoms according to a Lennard-Jones function and derivation of Young's modulus.

4. **Mechanical properties:** One of the most popular questions with a strong average mark. A question that made the candidate consider aspects of work hardening and slip planes in different crystal structures.

5. **Mechanical Properties**: Another highly popular question. The question required an understanding of dislocations and their role in cross-slip, plus how cross-slip occurred in different crystal structures

6. **Electrical and Magnetic Properties**: An unpopular question, but those who answered it got the highest average mark for all questions. The question explored the understanding of magnetic fields and electrical currents, with current loops and mutual inductance.

7. **Electrical and Magnetic Properties**: Also a very unpopular question. The question required knowledge of electromagnetic phenomena. The question style was mainly word descriptions of the behavior of systems, no formulas or equations were utilized.

8. **Kinetic Theory of Gases**: A moderately popular question with a decent average score. The question required deriving expression for pressure and the mean free path, and then using the understanding of the kinetic theory of gas to calculate quantitative values for a balloon filled with gas.

General comment:

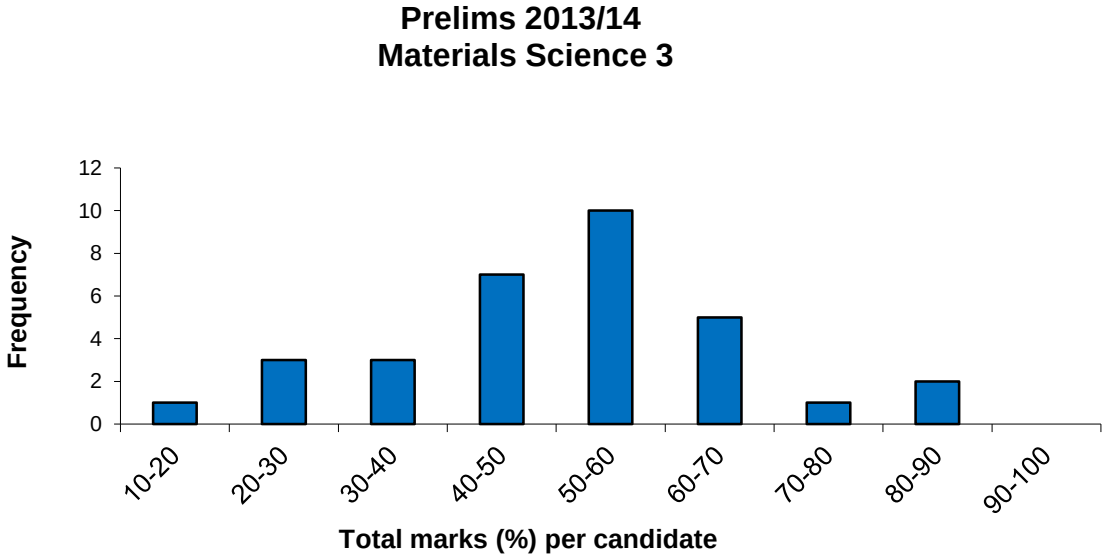
The mean mark is well positioned in regards to the distribution of high and low scores and the average mark. The mean mark is reduced from last year's excessively high value and in line with expected variations. There is a clear separation between questions popularity. The two questions on the Electrical and Magnetic properties, questions 6 and 7, were very unpopular with only 6 and 7 attempts. Question 3 on the elasticity and structure was also very unpopular with only 5 attempts. In contrast the two questions on the mechanical properties, questions 4 and 5, were very popular 31 and 30 attempts, so too were the first two questions on the elasticity and structure with 29 and 33 attempts. The question on the kinetic theory of gases, question 8, was also fairly popular. This seems to indicate that the questions on electrical and magnetic properties need to be looked to understand the reason behind the low number of attempts. It will be important to see whether the low number of attempts is due to the style of the questions, its difficulty, or disconnect between the lecture course material and the examinable material.

MS3 – Transforming Materials

Examiner(s): **Professor Marina Galano**
Candidates: **33**
Mean mark: **50.64%**
Maximum mark: **88%**
Minimum mark: **4%**

Detailed comments on the paper are as follows:

Question	No of Answers	Average Mark	Highest Mark	Lowest Mark
1	27	11.81	19	3
2	25	11.28	19	2
3	24	8.92	16	3
4	29	10.76	16	0
5	12	8.50	14	1
6	14	12.43	19	1
7	21	6.19	16	0
8	10	13.80	20	10



Specific Comments

1. **Thermodynamics, Carnot Cycle.** A popular question, 82% of the students attempted it and that had a wide spread in marks obtained. The structure of the question allowed for discrimination between the students' ability. Many students felt comfortable with these concepts.

2. **Thermodynamics fundamental.** A popular question, 76% of the students attempted it. Some students scored highly. Most students were able to solve parts (a) to (c), however only a few were able to answer part (d) correctly. Though part (d) was in essence a straightforward question it required a deeper understanding of the topic.

3. **Reaction Kinetics.** The question was attempted by 73% of the students however the average mark was low and again there was a wide spread in marks. Students had difficulties producing the graphs/methods requested particularly for determining the order of the reaction. This question has similarities to the ones asked in previous years but it stretched students further in needing a deeper understanding of the concepts.

4. **Electrochemistry.** The most popular question which again had a broad spread of marks over all those who attempted it. Most marks were lost in part (c) of the question.

5. **Polymer synthesis.** One of the least popular questions. Most of the available marks were for an essay-type response and marks were low. Some key concepts were confused.

6. **Processing examples.** This question required an essay-type response to different processing techniques straightforward from what was covered in the lectures. However, it was not a particularly popular question (42% of the students attempted it). It had a reasonably good average mark and some students score highly.

7. **Phase Diagram and Free Energy Curves.** The question was attempted by 63% of the students however it had the lowest average marks but the marks were spread over a wide spectrum. Though this type of question was covered in the course, in problem sheets and had appeared in prelims before, in general students had difficulties in building the phase diagram and subsequently sketching the free energy curves. Only a few were able to sketch the microstructures properly.

8. **Scheil equation:** This was the least popular question, but with the highest average mark. Full/high scores were obtained by some students showing it was within the reach of the students' understanding.

General Comments:

The average mark for this paper was down from last year though the paper was of similar level of difficulty to previous years. Compared to the other two Materials papers (MS1 and MS2), this one had the lowest overall average mark but this was also the case in the previous year. Each lecture course had students attempting the questions, indicating no topic or lecture course in particular was being actively avoided.

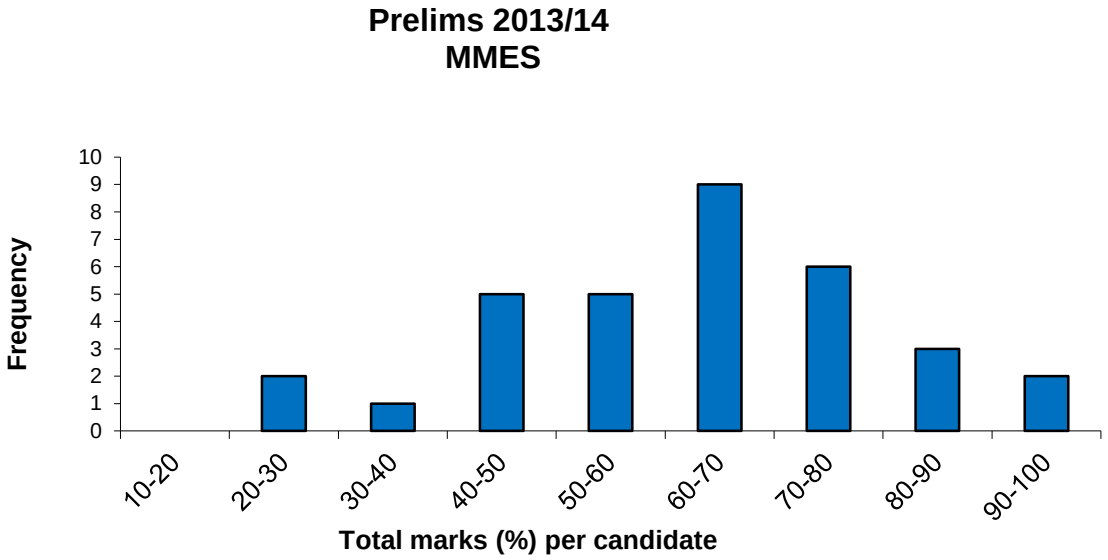
The distribution of marks is good suggesting that students' ability was discriminated appropriately, with some students scoring highly. However, a number of students produced very weak answers and consequently failed the paper.

Mathematics for Materials and Earth Sciences

Examiner(s): **Professor Jonathan Yates**
Candidates: **33**
Mean mark: **63.88%**
Maximum mark: **98%**
Minimum mark: **25%**

Detailed comments on the paper are as follows:

Question	No of Answers	Average Mark	Highest Mark	Lowest Mark
1	33	5.70	8	1
2	33	6.00	8	2
3	33	6.79	8	0
4	33	6.42	8	0
5	33	2.21	6	0
6	33	5.64	8	0
7	33	4.24	8	0
8	33	5.64	8	0
9	33	5.18	8	0
10	33	5.12	8	0
11	28	14.25	23	4
12	26	18.08	25	6
13	6	21.67	25	6
14	26	17.81	25	0
15	15	14.67	24	3
16	29	11.69	25	3



General Comments

The exam followed the pattern of previous years: Section A contained 10 compulsory questions worth 8 marks each, Section B contained 6 longer questions worth 25 marks each from which 4 had to be attempted.

Section A
Q1: geometry of planes and normal vectors
Q2: simultaneous equations and matrix inversion
Q3: transformations
Q4: partial derivatives
Q5: Stationary points and curve sketching
Q6: indefinite integral
Q7: complex numbers
Q8: Taylor expansion
Q9: evaluation of limit
Q10: first-order differential equation

Q5 on curve sketching caused numerous problems; even students who found the turning points couldn't sketch it correctly (it is just sinx/x shifted to the right…).

Section B
Q11 Vectors, planes and crystallography
The first parts were well done. The final (12 mark) question was attempted by only a small number of candidates, just one of whom produced an elegant solution.
Q12 Matrices, Eigenvectors
Generally well done.
Q13 Partial Differentiation
Not a popular question. Although it was standard, and those that attempted it scored high marks.
Q14 Integration
Some good answers. Some students struggled to setup the integrals for centroids and moments of inertia which caused them to score low marks.
Q15 Power series
Generally well done. A few students expanded in the wrong variable – and all made at least one numerical slip.
Q16 Differential equation
While this was a very standard question the average mark was rather low as many students made simple errors in the manipulating numbers. A significant fraction of the students could not write down the correct form of the particular integral.

The average was slightly up on last year, and on the whole I felt that candidates were better prepared. Many marks were lost by students not being careful with their arithmetic. It was pleasing that a few students produced near perfect scripts.

Examination Conventions 2013/14
Common Preliminary Examination
Materials Science and Materials, Economics & Management

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 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 are independent both of the Department and of those who lecture. The paragraphs below give an indication of the conventions to which the moderators 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, and the Proctors who may offer advice or make recommendations to the moderators.

The Moderators in Trinity 2014 are: Dr Jonathan Yates (Chair), Prof. Nicole Grobert, Dr Marina Galano and Dr Jamie Warner. 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 the Senior Tutor of your college, who will, if he or she deems the matter of importance, contact the Proctors. The Proctors in turn communicate with the Chairman of Prelims.

If there are believed to be mitigating circumstances, such as illness, which may have affected the candidate's progress with coursework or performance in a written exam these should be drawn to the attention of the Senior Tutor at the candidate's college as soon as practicable. The Senior Tutor will, if appropriate, inform the Proctors who in turn may communicate with the Chairman of Prelims about the mitigating circumstances. Subject to guidance from the Proctors, if appropriate the Board of Moderators will take into account these mitigating circumstances.

(1) *Setting of papers*

Each of the five papers in Prelims, comprising the 3 Materials Science papers, the Maths for Materials and Earth Sciences paper, and the Coursework Paper, carry equal total marks. The Moderators set the written papers, but are advised to consult the course lecturers. The course lecturers are required to provide draft questions if so requested by the Moderators. The Prelims paper on Maths for Materials and Earth Sciences is set jointly by the Departments of Earth Sciences and Materials. There are no external examiners for Prelims. The assessed work for the practicals and the crystallography classes together constitute the Coursework Paper.

(2) *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 total marks available for each of these papers are 100. The Prelims paper on Maths for Materials and Earth Sciences consists of two sections, candidates are required to answer all questions in Part A and 4 from Part B.

(3) *Coursework paper*

The Coursework Paper comprises two elements of coursework: a set of eight reports of practical work as specified in the MS/MEM 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). 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 of work' clause of the 'Regulations for the Conduct of University Examinations' section of the Examination Regulations (Part 16, 'Marking & Assessment' in the 2013 Regulations).

* for the 2013-14 examinations the Nominating Committee comprised Prof Grovenor & Dr Taylor.

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

(a) With permission from the Proctors under clause (2) of para 16.8 no penalty.

(b) With permission from the Proctors under clauses (3) or (4) of para 16.8, 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 clauses (3) or (4) of para 16.8, 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 and Materials, Economics & Management, 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 and Materials, Economics & Management, 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/MEM 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 2013/14 version) and are **separate** to the provisions described above.

(4) *Marking of papers*

For prelims double marking is not necessarily double "blind" marking. It is usually considered sufficient for the second marker merely to check the first marker's marks.

(4) *Marking of course practicals and crystallography classes*

First year practicals are assessed regularly by senior demonstrators in the teaching laboratory. The work done for crystallography classes is assessed by the Crystallography Class Organiser(s). Satisfactory performance in the practical work and in the crystallography classes is defined in the MS/MEM Prelims Handbook.

(5) *Classification*

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.

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 + $\underline{\mathbf{3}}\times(4+2)$} for both failures to be compensated

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

(6) *Failure of one or more Papers*

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.

Candidates who pass the coursework paper and fail 1 or 2 written papers will be asked to resit only those written papers.

Candidates who pass the coursework paper and fail more than 2 written papers will be asked to resit all 4 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 prevented from continuing to Part I. Exceptionally, a college may allow a student to go down 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.

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		
	2013/14	2012/13	2011/12	2013/14	2012/13	2011/12
Distinction	n/a	n/a	n/a	n/a	n/a	n/a
Pass	26	21	28	100	100	97
Fail	0	0	1	0	0	3

(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

None this year.

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

The objectives and marking criteria for the Modelling and Characterisation Module reports should be written down and made available to both the candidates and the Examiners.

There was some discussion with one of the external examiners as to whether double blind marking was the best and most efficient method of ensuring allocation of the correct marks. This is worthy of discussion.

D. EXAMINATION CONVENTIONS

The previous year's Examination Conventions were included in the Course Handbook that was distributed to all candidates in hard-copy and was also made available on the Departmental website, to which candidates' attention was drawn by e-mail. 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 13 March 2014, and in hard copy for the start of Trinity term. 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 26 candidates for the examination, and all 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; two candidates 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 (five candidates) or one on Materials Modelling (fifteen candidates). There were three candidates returning from withdrawals: one returned at the start of Michaelmas Term, completing the team design project and option module, another returned at the start of Hilary Term completing the option module and a third returned to sit the written papers. None was required to redo coursework already completed.

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, one of whom was the Chairman. Teams were marked as groups. The allocation of bonus or penalty marks is permitted under the Conventions, but this was not found to be appropriate to any of the students this year.

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.
See further comment in Section E.

Candidates' work on the two coursework modules was marked by two Assessors. The Chair of 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 as pass/fail by the Industrial Visits Organiser, appointed as an Assessor.

The overall mean mark for Part I was close to the middle of the 2(i) 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 63.33, F 60.32% (Overall 62.06%)
Coursework Averages – M 72.78%, F 74.23% (Overall 73.39%)
Overall Part I Averages – M 65.69%, F 63.80% (Overall 64.89%)

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 ±10.95% points for the male candidates and ±10.45% points for the female candidates. Both male and female groups of candidates performed better in the coursework than in written examinations.

Where approved by the Proctors, candidates were allowed (i) extra time on account of dyslexia / dyspraxia, and/or (ii) other special arrangements. These allowances seemed satisfactory.

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

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

One medical certificate was received and considered for illness during the written paper, which the examiners considered carefully and a fair course of action was agreed.

[redacted]

It was reported to the incumbent examiners that one team had submitted their Business Plan late last year (approximately 2.5 hours after the deadline). The Proctors permitted the work to be accepted and considered by the examiners, and the examiners last year had recommended that an academic penalty be imposed, in line with those described in the conventions (the examiners had agreed on a penalty of 5%). This recommended penalty was applied.

F. NAMES OF MEMBERS OF THE BOARD OF EXAMINERS

Prof. R.I. Todd (Chairman)	Prof. S.C. Benjamin
Prof. J.T. Czernuszka	Prof. C.R.M. Grovenor
Prof. A.I. Kirkland	Prof. J.M. Smith
Prof. M.G. Burke (external)	Prof. P.D. Haynes (external)

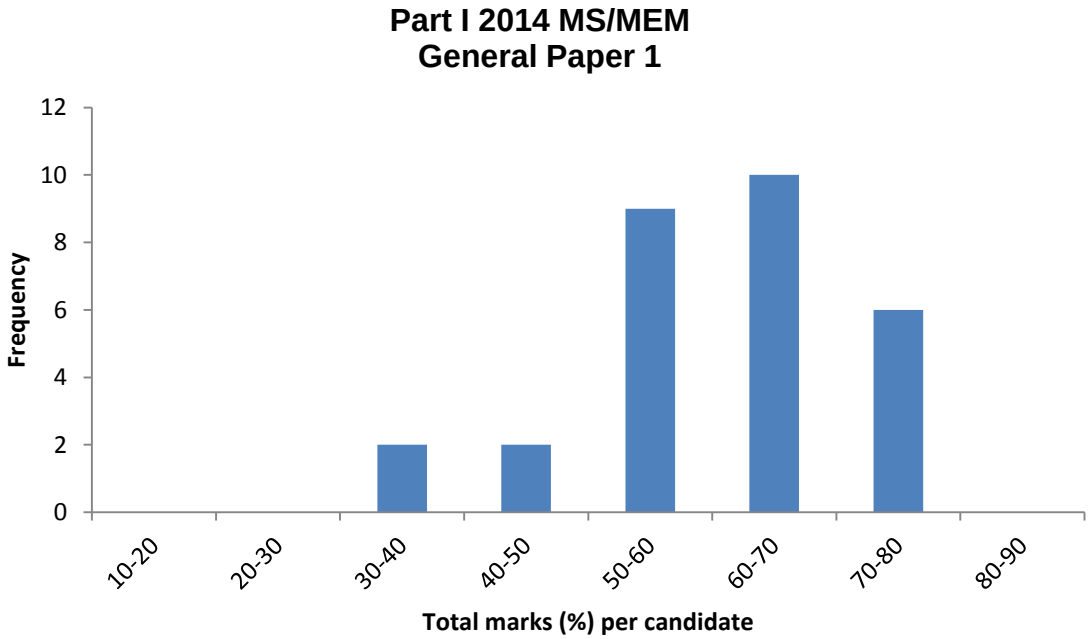
Attachments: Examination Conventions 2013/14 Final Honours School Materials Science
Comments on General Paper 1
Comments on General Paper 2
Comments on General Paper 3
Comments on General Paper 4
Comments on Materials Options Paper 1
Comments on Materials Options Paper 2

General Paper 1 – Structure and Transformations

Examiner: **Professor Chris Grovenor**
Candidates: **29 (26 MS / 3 MEM)**
Mean mark: **60.72%**
Maximum mark: **75%**
Minimum mark: **38%**

Detailed comments on the paper are as follows:

Question	No of Answers	Average Mark	Highest Mark	Lowest Mark	Topic
1	18	10.78	13	8.5	Corrosion (Pourbaix Diagram)
2	27	13.28	17.5	4	Corrosion (Passivity)
3	22	12.20	17.5	2	Diffusion
4	15	10.70	15	5	Surfaces and Interfaces
5	24	14.02	19	5.5	Nucleation
6	18	12.44	18.5	6	Ternary Phase diagrams
7	11	9.41	14	6	Powder Metallurgy
8	10	11.00	14	7	Polymer and dendrite shapes



General Comments:

The general performance of the candidates on this paper was quite good, and the marks spread suggested that it stretched the weaker candidates while allowing the stronger ones to perform well. Even the less popular questions (7 and 8) were chosen by at least 10 candidates. The paper average was within the target range.

Question 1. A very standard question on constructing a Pourbaix Diagram from data given in the question. A relatively low average mark because of the rather poor attempts at part b)

a) and d) Most candidates could describe the basic features of a Pourbaix Diagram well.

b) Few made a good attempt at constructing the diagram, with a variety of numerical mistakes and incorrectly balanced equations.

c) Without a good attempt at b), it was hard for candidates to achieve many marks on this part.

Question 2. A very popular question and rather well answered in general. The candidates were invited to show what they knew about passivation, and could mostly show some detailed understanding.

a) On the basic process of passivation, and generally well answered.

b) It was surprising that not all the candidates could state which common metals are protected by passive layers nor define the passivating phase formed.

c) Many candidates, but by no means all, could construct a simple Evans diagram.

Question 3. Another popular question on interstitial and isotopic diffusion.

a) Most candidates could define why diffusion in ceramics is generally slow.

b) Candidates fell into 2 camps – those who could with confidence discuss the equations governing interstitial diffusion, and those who did not attempt this part.

c) Parts (i) and (ii) done well by almost all, but some did not know that the error function was the appropriate solution to Fick II in (iii). The very simple calculation in (iv) required knowing the approximation for using the error function, and by no means all candidates did.

Question 4. Surfaces and Interfaces question that examined part of the course that is not often asked, which perhaps explains why the average mark is low.

a) Many could describe surface reconstruction, but some of the techniques selected to study this phenomenon were surprising.

b) This part of the question was on solute enrichment factors, and while some candidates were confident in describing the thermodynamic basis for different behaviours others had only the haziest understanding of what governs solubility in an alloy system.

Question 5. A popular question on precipitation that was generally very well answered.

a) The sequence of stages in a typical precipitation reaction was explained clearly by most candidates.

b) This part on the equation for nucleation rate was the least well answered, with some woolly definitions of the parameters and their physical meaning.

c) Many candidates had a good grasp of nucleation in the eutectoid transformation.

Question 6. A slightly non-standard ternary phase diagram question in that it involved a ternary peritectic reaction. Many candidates constructed the isothermal section very well, making the correct decisions on the sequence of reactions apparently without difficulty.

a) It was disappointing that some candidates could not construct a binary phase diagram from the data given in the question – something they should have been able to do in the first year.

b) Those that could do the isothermal section scored very well, but some candidates made no serious attempt at this part.

c) Unless b) was done well, this part was not possible, but even those who had successfully completed the isothermal section made some curious choices made about the path of the reactions.

Question 7. Relatively unpopular bookwork powder metallurgy question until the final part which introduced a calculation from the Phase Transformations course.

a) Even though parts a) and b) required little more than a clear summary of material covered in detail in the handouts, few candidates were able to score very well.

c) This part required the candidates to use an equation from the Phase Transformations course, and almost no candidates were able to see that this is what was required.

Question 8. A question that combined the thermodynamic background to microstructure in polymers and dendritic growth. Rather unpopular and not very well answered.

a) Most candidates performed better at this part of the question than part b, and were able to describe lamellar polymer crystals with some confidence.

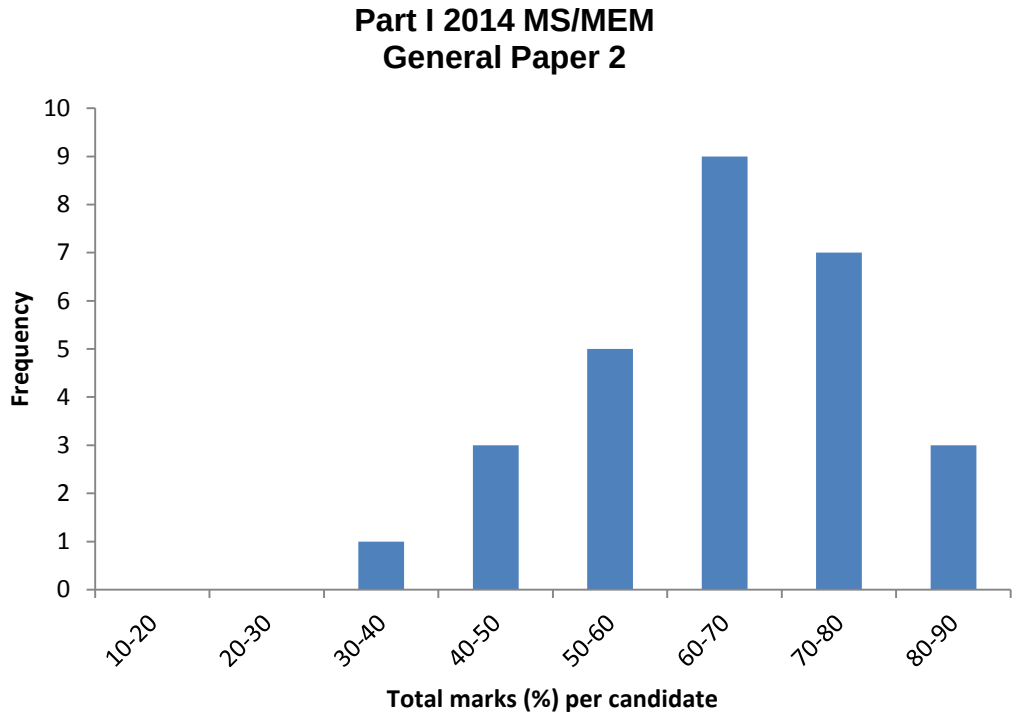
b) Bookwork explanation for the balance of thermodynamics and kinetics in dendritic growth, but not attempted well by most candidates.

General Paper 2 – Electronic Properties of Materials

Examiner: **Professor Jason Smith**
Candidates: **29 (26 MS / 3 MEM)**
Mean mark: **66.28%**
Maximum mark: **93%**
Minimum mark: **40%**

Detailed comments on the paper are as follows:

Question	No of Answers	Average Mark	Highest Mark	Lowest Mark	Topic
1	28	12.95	18	6	Quantum Mechanics
2	26	14.90	19.5	6	Statistical Mechanics
3	19	13.00	18.5	2	Electronic Structure of Materials
4	14	13.50	18.5	8.5	Semiconductor Materials
5	5	9.90	13	7	Electrical & Optical Properties
6	12	14.21	18.5	4	Electrical & Optical Properties
7	16	14.63	17.5	11.5	Magnetic Properties
8	25	10.92	17.5	5.5	Tensor Properties of Materials



Detailed comments:

1) Quantum mechanics.
The most popular question on the paper and generally well done. Some students struggled a bit with change of axis range for the square well potential compared to that used in the lectures, but several navigated this well. Only a few were able to make a convincing argument for the general solution in b(ii), and most substituted back in to show that it was a solution, for which partial marks were awarded.

2) Statistical mechanics.
Another very popular question, also answered well. Good general appreciation of the basics of statistical mechanics and relationship to second law. Most students were also able to demonstrate understanding of the use of the partition function by correctly setting up the 'three level system' which had not been covered explicitly in lectures, and derive the paramagnetic susceptibility.

3) Electronic Structure of Materials.
Attempted by about 2/3 of candidates, with quite good answers. Part a generally well done, but with a few sloppy answers in which definitions of valence and conduction bands were specific to metals. Several struggled with sketching the band structure in part (b), but once this was in place were able to complete the question. Nearly all were able to distinguish accurately between direct and indirect band gaps. Differentiation of trig functions to get to effective mass in part b(v) was frequently poor and relatively few obtained the correct numerical answers.

4) Semiconductor Materials.
Attempted by half the candidates, with a good range of answers. Surprisingly few could list the four materials in order of increasing band gap in part (a). Most had a good sense of the distinction between intrinsic and extrinsic behaviour but some answers were poorly worded and not many made the link between a narrow gap and dominant intrinsic behaviour. Parts (b) and (c) were generally done quite well, although clearly in some cases reliance on memory of graphs in part (c) provided a poor substitute for clear understanding.

5) Electronic and Optical Properties of Materials. The least popular question with only five attempts, and generally poorly done. A couple of students misread part (a) and gave detailed explanations of optical polarisation mechanisms rather than electrical polarisation mechanisms, thus losing a lot of marks and lowering the average. Part (b) was generally well done. Part (c) was found challenging though, and most students were not able to identify the Brewster criterion from the Fresnel equations. No correct answers to c(iii).

6) Electrical and Optical Properties of Materials.
A question on piezo/pyro/ferroelectricity attempted by just under half of the students and reasonably well done overall. Most students were able to define the three phenomena accurately with some grasp of the requirements placed on crystal structure. Many were able to identify that hBN should be piezoelectric but graphene not, and neither should be pyroelectric. Several correct answers were given to the numerical question in part (c).

7) Magnetic properties of materials.
Attempted by about 40% of candidates and reasonably well done. Most could place the four parameters on a hysteresis curve and give reasonable definitions in part (a), although permeability was often confused for susceptibility. Part (b) produced some good descriptions of combinations of parameters needed for different applications. Most struggled with the calculation in part (c), and only one candidate produced a well-supported answer for the power required to drive the electromagnet.

8) Tensor properties of materials.
A very popular question, but generally done quite poorly. In part (a), nearly all students knew that tensors were used for anisotropic properties, but many did not explain how the representation works as requested. Several gave stress or strain as an example of a matter tensor. For part (b) there were some good answers, although several students discussed the symmetry axes of crystals rather than the principal axes of the properties being described. Most struggled with part (c), the most common mistakes being losing track of axes, rotating by 45 degrees from [001] to [101] despite the tetragonal lattice structure, and using incorrect equations for the relationship between the electric field and the polarisation.

General Comments:

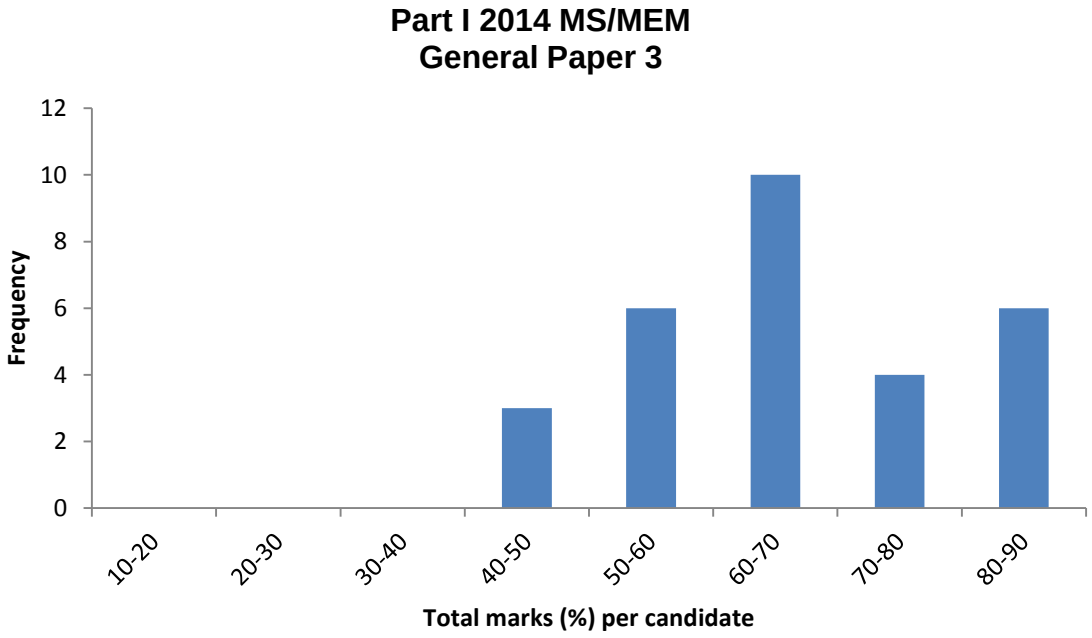
The paper produced quite a wide spread of marks, with a few very high scores and several quite low ones, and a mean mark of 66.28%. All candidates attempted five questions, and all candidates achieved a mark of 40% or higher. The most popular questions were on quantum mechanics, statistical mechanics and tensor properties, and the least popular was a question on the optical properties of materials. The better candidates showed good understanding in the questions they attempted, and were able to apply their knowledge and problem-solving skills to unfamiliar scenarios and extract quantitative answers. Poorer candidates relied heavily on memorising facts and figures and were less able to cope with nuanced questions or problems that differed from those covered explicitly in the lectures or tutorial sheets.

General Paper 3 – Mechanical Properties

Examiner: **Professor Richard Todd**
Candidates: **29 (26 MS / 3 MEM)**
Mean mark: **67.14%**
Maximum mark: **90%**
Minimum mark: **41%**

Detailed comments on the paper are as follows:

Question	No of Answers	Average Mark	Highest Mark	Lowest Mark	Topic
1	19	11.63	17.5	6	
2	19	14.32	18	9	
3	19	14.34	19.5	5.5	
4	12	15.17	19.5	8.5	
5	25	12.12	17	3	
6	13	11.23	19	3	
7	14	12.54	16.5	6.5	
8	24	15.35	19.5	2	



General Comments

The overall marks are satisfactory: all candidates achieved over 40% and the mean mark was at the high end of the 2(i) classification range. The significant number of students achieving marks in the range 80-90% demonstrates that the questions were fair. All questions were attempted by over a third of the cohort. Those questions with lower mean marks (e.g. 1 and 6) had a bimodal marks distribution, with very high marks for students who were familiar with the area examined by the question and low marks for some students who simply did not know the basics. The satisfactory overall marks distribution suggests that these questions were the "last choice" of the weaker candidates.

Comments on Individual Questions

Q1. Strongly bimodal marks distribution with six 1st class marks, eight 3rd or fails and only three marks in the 2.1/2.2 range. This was apparently because of the strong bookwork content of the question: candidates who knew the material scored highly but about half of those attempting the question simply did not know much about this area.

Q2. Discursive question with some very good answers. Some weaker candidates misinterpreted part (b) as requiring answers for different types of polymer (amorphous, necking, thermoplastic) but managed to pick up some marks despite this. Not many candidates really made the most of the main "novel" part of the question, which was to contrast the behaviour of polymers with that of metals.

Q3. Mathematical question in which the majority of candidates scored 1st class marks, several with 19 or 20. The minority with low marks tended to lose marks primarily through not understanding or knowing about this area rather than any lack of mathematical ability.

Q4. Less popular question, possibly because it was a slightly different format to previous years. The majority of candidates who attempted it got first class marks, several with 19 or 20. The few candidates with low marks did not know basic definitions such as the Burgers circuit sufficiently rigorously.

Q5. Very popular question on age hardening. Most candidates knew the gist of the arguments but few were familiar with the details. Nevertheless, the modal score was in the 2.1 bracket and a comfortable majority scored 2.1 or 1st class marks.

Q6. Unpopular question with very bimodal marks distribution. Around half of those answering the question had evidently chosen it on the basis that they understood the subject matter and scored highly. The other half did not have sufficient knowledge to pick up many marks.

Q7. The majority of candidates scored a 1st class or 2.1 mark on this and parts (a) and (c) were generally done well by most, although several candidates failed to use a value for the indentation load appropriate to its units (N). However, few candidates could describe the origin of the test (part (b)) in much detail.

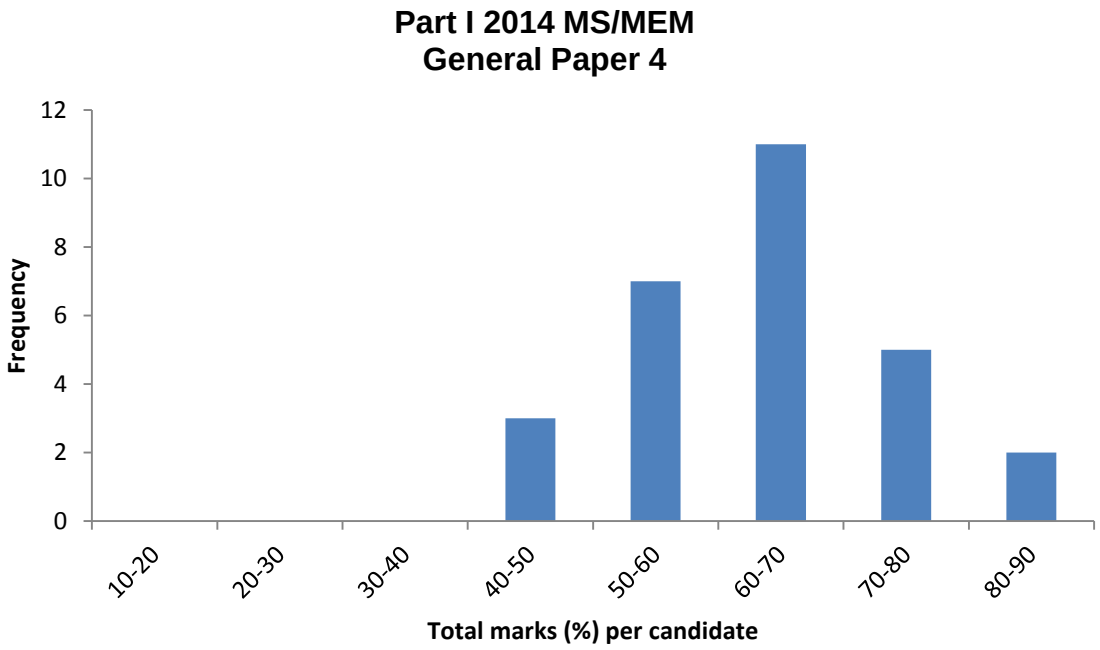
Q8. Straightforward question with main points captured by the majority of candidates.

General Paper 4 – Engineering Applications of Materials

Examiner: **Professor Jan Czernuszka**
Candidates: **29 (26 MS / 3 MEM)**
Mean mark: **65.28%**
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	9	12.17	15.5	9	Polymers
2	25	13.60	19.5	4	Microstructural characterisation
3	16	12.66	18.5	1	Microstructural characterisation
4	23	12.04	18.5	3.5	Ceramics and glasses
5	25	15.94	19.5	11	Ceramics and glasses
6	16	11.22	17	4	Semiconductor Devices
7	14	10.61	17	6.5	Engineering Alloys
8	17	13.47	18.5	7	Engineering Alloys



General Comments

Overall, the standard was high with some very high scores that were pleasing to mark.

Question 1 Polymers

An unpopular question. Part (a) and (b) on semiconducting polymers – generally well answered; parts (c) and (d) on ionic polymers that was less well answered. Candidates lost marks by confusing ionic and semiconducting polymers.

Question 2 Microscopies

A popular question. Parts (a) and (b) were generally well answered and candidates understood the main aspects. Part (c) led to some confusion and most marks were lost here.

Question 3 Electron diffraction

A straightforward question on diffraction contrast and diffraction patterns. Most candidates answered this question well with some very high marks. Most marks were lost in (c) part iii).

Question 4 Disorder in ceramics

A popular question. A question on Frenkel and Schottky defects in ceramics. Most candidates answered parts (a) and (b) well. Marks were lost in (c) by candidates not describing the various mechanisms of unbalanced defects.

Question 5 Sintering

A popular question. General question on different types of sintering. Some exceptionally good answers. Marks were lost in part (c) by using incorrect processing routes.

Question 6 Diodes

Part (c) caused the most difficulty especially when dealing with the materials aspects of the devices.

Question 7 Superalloys

A reasonable spread of marks with a low mean. A general discussion about superalloys in the first part with a simple substitution and integration in the mathematical part. There was an error in the equation in the examination script, with an incorrect subscript on a variable. This made the final part of the question impossible to complete, as was recognised by the examiners during the marking process. The two examiners took this error into account, marking generously when candidates were able to show progress in setting up the problem mathematically. As there was no evidence that the errors influenced the candidates' choice of question, it was proposed that this allowance be considered sufficient, and this approach was endorsed by the external examiners.

Question 8 Al alloys

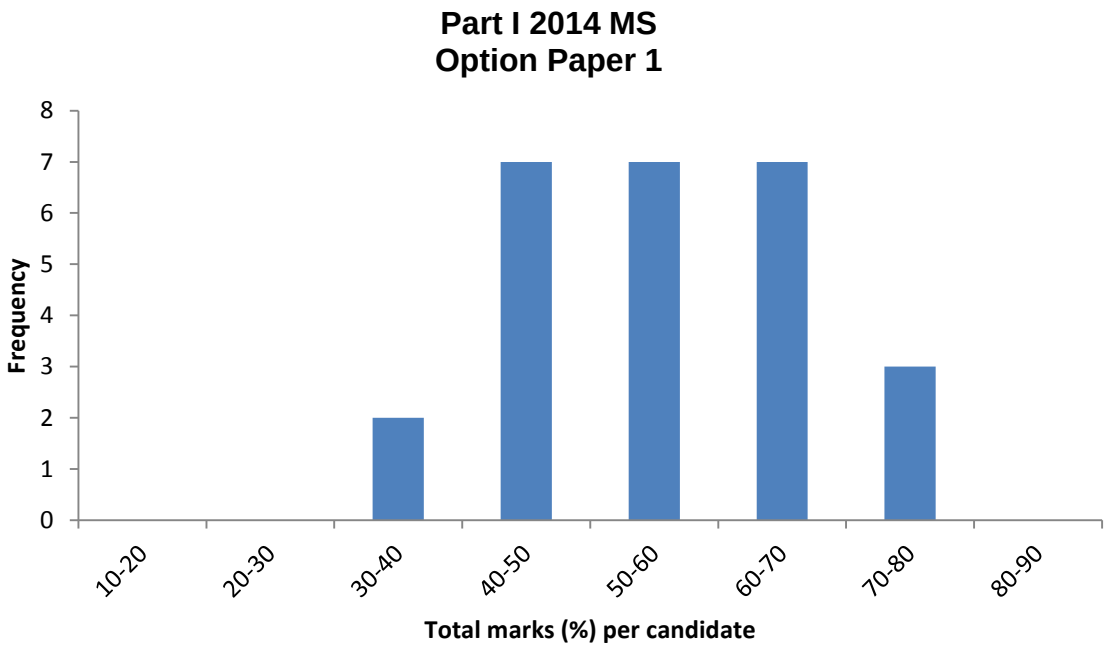
A 3-part question. The first part was a general introduction to alloy strengthening. The second part required analysis of data on age hardening. The third part was a numerical question/estimate. Part (c) seemed to have the lowest marks.

Materials Options Paper 1

Examiner: **Professor Angus Kirkland**
Candidates: **26 (MS)**
Mean mark: **55.14%**
Maximum mark: **89%**
Minimum mark: **29%**

Detailed comments on the paper are as follows:

Question	No of Answers	Average Mark	Highest Mark	Lowest Mark	Topic
1	18	13.33	23.5	5	Strength & Failure of Materials
2	6	12.00	20.5	5	Strength & Failure of Materials
3	8	15.38	23	8	Nanomaterials
4	9	16.83	23	10.5	Nanomaterials
5	7	16.14	20.5	10.5	Prediction of Materials Properties
6	6	11.58	18	8	Prediction of Materials Properties
7	7	10.93	16	5.5	Materials and Devices for Optics & Optoelectronics
8	10	12.35	16	7	Materials and Devices for Optics & Optoelectronics
9	17	13.41	21	1	Engineering Ceramics: Synthesis & Properties
10	16	14.69	20.5	6.5	Engineering Ceramics: Synthesis & Properties



Detailed Comments

1. A popular question in which a majority of candidates scored 1st or 2nd class marks. For these candidates, most parts were well done but few seemed to have learnt the abrasive wear version of the Archard equation. Some very low marks for a few candidates suggests they were fugitives from other courses.

2. Question on fatigue attempted by only a few candidates. Several of those attempting it had neither an understanding of what a stress intensity factor is nor sufficient recall of the basics of the cyclic plastic zone. However, the top mark was high in the first class category, demonstrating that the question was a fair one for those interested in fatigue.

3. The majority of attempts scored 1st or 2.1 marks. The main principles were evident in most of the discursive answers. Most candidates were unable to get all the terms precisely correct for the chemical potentials but the general idea was satisfactory for many.

4. Question concerning quantum dots and SWCNTs in which many candidates displayed a good understanding of CNT structure and properties and the main points concerning quantum dots.

5. A question on Density Functional Theory that was only attempted by a small number of candidates. Weaker candidates, in general failed to score any marks in part d) but the better candidates tackled this section well suggesting that the question overall was fair. A surprisingly high number of candidates lost marks by failing to convert their answers into gPa as required successfully.

6. A QM question that was only attempted by a few candidates. In general the answers were poor with only a few candidates scoring 2:1 or 1st class marks. Marks were lost in all sections but only two candidates made any real progress in section d).

7. Another unpopular question that was badly answered with no first class marks achieved. Almost all candidates answered sections a) and b) reasonably but few made any significant headway with the calculations in c).

8. Attempted by 30% of the candidates with a narrow spread of marks, although none first class. All candidates made good attempts at section a) but section b) was poorly answered with many candidates failing to understand the definition of power density in b)(i). Section c) was more descriptive and answered well by the stronger candidates.

9. Popular ceramics question based on subcritical crack growth. Attracted a wide range of marks but many candidates showed a good understanding of this subject.

10. Question on processing and applications of alumina-based ceramics. Again, a wide range of marks. Most candidates showed familiarity with the subject but several did not have sufficient grasp of detail to score very highly.

General Comments

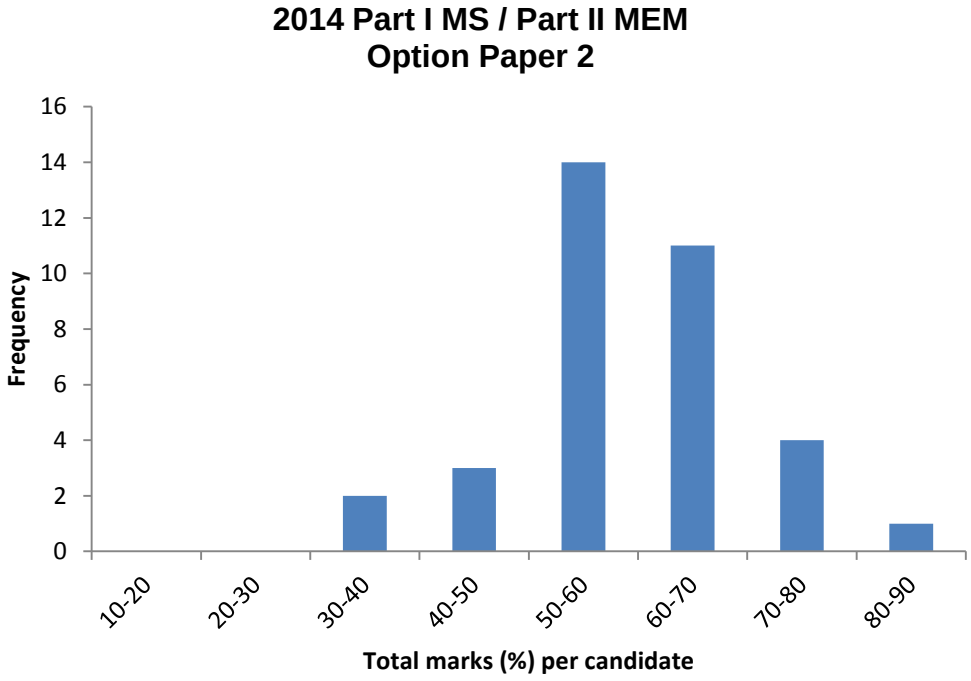
Mean marks for paper OP1 were low this year and the examiners considered whether scaling should be applied. However, reviewing the range of marks it was clear that the questions were fair and that there was evidence for the low mean mark being attributed to a wide spread of marks across questions for a number of candidates.

Materials Options Paper 2

Examiner: **Professor Simon Benjamin**
Candidates: **35 (26 MS / 9 MEM)**
Mean mark: **59.11%**
Maximum mark: **82%**
Minimum mark: **33%**

Detailed comments on the paper are as follows:

Question	No of Answers	Average Mark	Highest Mark	Lowest Mark	Topic
1	13	15.65	21.5	9	Polymer blends and copolymers
2	11	15.18	18	11.5	Recycling plastics & SANS experiments
3	18	14.28	22	6.5	Processing of steels
4	25	14.62	22	4.4	Eutectic alloys and melt processing
5	4	9.13	15.5	3.5	Energy production, distribution & storage
6	9	15.11	21.5	10.5	Fuel cells, hydrogen production & heat exchangers
7	4	16.25	21	10.5	Spinodal reactions
8	8	14.81	21	5.5	NiAl intermetallics
9	19	13.76	19.5	7.5	Biomaterials and bioreactivity
10	18	15.78	22.5	6	Bioresorbable and bioinert polymers
11	7	14.29	19.5	9.5	Electroceramics
12	4	16.63	20.5	13	Magnetic properties, magnetoresistance & magnetic hysteresis curves



General Comments

SECTION A ADVANCED POLYMERS

1) A popular question on polymer blends and copolymers. (a) Most candidates correct distinguished the key distinguishing features. (b) Most candidates demonstrated reasonable understanding of the principle of mixing in the presence of a solvent; some would have benefitted from a more careful reference to entropy. (c) Sketches of morphology changes were generally good, with reasonable accompanying explanations. Not all candidates paid attention to the instruction, "In your answer, consider how this compares with metal alloys." (d) On control via processing parameters was generally not well answered with several candidates not understanding what was meant by "processing parameters". (e) On differing morphologies and consequent properties: Most candidates able to gain some marks here but few able to say enough for full marks.

2) A four part question divided into two halves, (a) and (b) on recycling plastics, and (c) and (d) on SANS experiments. (a) On use of products beyond 'first-life' was well answered with the majority of candidates able to gain most or all marks available. (b) On the origin and consequences of poor mixing in recycled plastics – moderately well answered with most candidates able to make some useful remarks. (c) Requiring candidates to consider a SANS experiment and identify which mix would give a contrast match – generally well answered, although some candidates confused by the easy nature of the question and seeking to perform more elaborate analysis. (d) On surveying different plot types – almost all candidates were able to name and describe one or two types, and several candidates able to describe a full set of four.

SECTION B ADVANCED MANUFACTURE WITH METALS AND ALLOYS: PROCESSING, JOINING AND SHAPING

3) A question on the processing of steels. Most candidates were able to sketch the casting arrangement for continuous and twin roll casting in part (a). A wide range of answers were given in part (b) comparing solidification conditions, with only a few relating that size of microstructure to the cooling speed. Generally good answers to part (c) on the economic and technical benefits of the two methods. Parts (d) and (e) on joining and corrosion protection were generally well done.

4) A popular question with 25 attempts. Question had 5 parts. (a) On near eutectic alloys: generally well answered with appropriate diagrams. (b) On squeeze casting: well answered except that for a few candidates who simply did not know what squeeze casting is. (c) On melt-processing: Not well answered in general, several candidates described the use of Si instead of SiC. (d) On the problems of joining these materials – most candidates have some correct remarks to make. (e) generally well answered with the stronger candidates describing both pros and cons.

SECTION C
MATERIALS FOR ENERGY PRODUCTION, DISTRIBUTION AND STORAGE

5) The question with the lowest average mark in the exam, and one of the least popular. Of the 4 attempts, 2 were reasonable, but 2 were very poor. The question had 3 parts. Part (a) asked about factors that "influence the average annual power output" of various kinds of power station. Generally candidates did not focus on the factors affecting the amount of time a system can be active (as the question setter intended) but rather gave factors affecting instantaneous power output. However since the question did not make the context completely clear, these answers were accepted. Part (b) concerned fast breeders, with some reasonable responses. Part (c) concerned the Chernobyl disaster; no comprehensive answer was produced but some relevant factors were identified.

6) A three part question on fuel cells, hydrogen production and heat exchangers. The first part concerning fuel cells was well answered, with candidates reproducing the figure from the lecture notes with good explanations. The second part on hydrogen production also generally received good answers. The third part was a calculation relating to thermal change in a heat exchanger – the analytic part of the calculation was not well attempted with only one candidate producing an approximately correct answer. It should be noted that there was an error in the question itself for the very last 2 marks – candidates were asked to put numbers into their derived formula but in fact the set of parameters given was not sufficient to evaluate the quantity. Only a few candidates reached that stage of the question, and the examiners decided to grade those efforts in such a way that any reasonable attempt that the last part would be generously marked.

SECTION D
ADVANCED ENGINEERING ALLOYS AND COMPOSITES

7) Spinodal reactions. Most candidates understood the basic concept quite well, both in terms of observed phenomena and underlying physical mechanism. Variable answers to part (c) distinguishing coherent and chemical spinodal, and outlining the Cahn Hilliard model. Some answers to the latter were very detailed and few were able to pick out the key points in an efficient way.

8) A question on NiAl intermetallics, generally well answered. Most candidates knew the crystal structures and made good attempts at describing the active slip systems, although many struggled to identify the key elements of the dislocation motion that determined the mechanical properties. For part (c) however, most candidates were able to identify hydrogen embrittlement at grain boundaries as the principal mechanism for low ductility in polycrystalline Ni3Al.

SECTION E
BIOMATERIALS AND NATURAL MATERIALS

9) Biomaterials and bioreactivity. Popular and generally well done. Parts (a) and (b) on the bioreactivity spectrum and attachment of ceramic bone substitute to a host bone were well answered. Part (c) elicited slightly more variable quality of answer as it required a deeper understanding of the mechanisms for increased resorption.

10) Part (a) was on the relative merits of bioresorbable and bioinert polymers for a variety of biomedical procedures and replacement parts. This was generally very well done, although some candidates struggled to articulate clearly the main reasons for choices made, possibly relying heavily on memory of notes. Part (b) on collagen was generally well done.

SECTION F
DEVICES, MEMORY AND STORAGE

11) Electroceramics. Answers to part (a) on domains and poling were variable with several candidates confusing domain formation in ferroelectrics with that observed in ferromagnets. Part (b) on controlling the temperature dependence of permittivity in barium titanate by shifting and broadening the resonance with doping, and part (c) on lambda sensors, were bookwork and generally well done.

    Overall I would say that the balance between knowledge and understanding is broadly as expected. Most candidates showed a good knowledge of the subject matter, and the better candidates showed that they understood the principles behind the facts and could produce well-reasoned answers.

12) An unpopular question with only 4 attempts. The question is in three parts, with the first two parts concerning the origins of magnetic properties, and the phenomena of giant magnetoresistance and tunnelling magnetoresistance. This was generally well answered with candidates reproducing standard explanations with diagrams, etc. as one would find in a textbook. The last part of the question concerns the use of the Stoner-Wohlfarth to obtain simple magnetic hysteresis curves. Here the candidates demonstrated a general sense of what they were supposed to do and the results that should be obtained, but in terms of the step by step analysis there was some broken logic and confusion.

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 (%)		
	2013/14	2012/13	2011/12	2013/14	2012/13	2011/12
I	8	8	7	36.4	29.6	31.8
II.I	8	16	11	36.4	59.3	50.0
II.II	5	3	2	22.7	11.1	9.1
III	1	0	2	4.55	0	9.1
Pass	0	0	0	0	0	0
Fail	0	0	0	0	0	0
Total	22	27	22	-	-	-

(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 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 who had read the thesis fully but the other examiners also had the opportunity to ask questions.

(3) **Marking of theses**
All theses were double blind marked by two internal Examiners, 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 who read the thesis provided the greatest input to the decision making process.

B. NEW EXAMINING METHODS AND PROCEDURES

In previous years, each thesis has been read fully by one external Examiner. The externals were asked only to inspect the theses in outline this year. This was partly because of the practical difficulty of one person reading so many theses with sufficient care in the short time available and partly because the external would on average be less well qualified to read any particular thesis than the internals, to whom the theses are distributed on the basis of their areas of speciality. These two factors combined with the respect for the view of the externals given by the Board of Examiners could lead to a less rigorous mark in combination with a less efficient system.

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

The inspection of all Part II theses by an external Examiner, rather than a full reading as in previous years, was successful and had the support of the externals concerned. It is recommended that this become the normal procedure in future.

D. EXAMINATION CONVENTIONS

The previous year's Examination Conventions were included in the Course Handbook that was distributed to all candidates in hard-copy and was also made available on the Departmental website, to which candidates' attention was drawn by e-mail. The current year's Conventions (2014, attached) were put on the Departmental website and sent electronically to all candidates on 13 March 2014, and in hard-copy for the start of Trinity term. The Examination Conventions were assessed by the Board of Examiners and the Department's Academic Committee.

Part II

A. GENERAL COMMENTS ON THE EXAMINATION

There were 22 candidates for the examination and all were awarded Honours. The examination required the candidates to submit a thesis (maximum 12,000 words) on a research project carried out by candidates during the year, usually in the Department of Materials. Candidates were given a 25 minute viva, during which they were asked detailed questions on their thesis and research work.

The theses were generally of a high quality, and most candidates were able to explain their work well in the vivas. The marks for the Part II examination ranged from 55% to 80%, with an overall mean mark towards the top of the 2(i) range. The external Examiners played an important role in deciding the final marks for the candidates and the Chairman would like to express his thanks to both of them for their hard work in inspecting so many Part II theses and contributing greatly to the vivas.

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.

If necessary, where approved by the Proctors, the Examiners took into account the impact of dyslexia and other specific learning difficulties and/or other special arrangements. These allowances seemed satisfactory.

	Overall mark		Part 2 Project		Part I Mark	
mark (%)	Male	Female	Male	Female	Male	Female
40–50	1	-	-	-	2	-
50–60	4	5	2	2	4	5
60–70	3	1	7	2	3	1
70–80	7	1	5	3	5	1
80–90	-	-	1	-	1	-
Totals	15	7	15	7	15	7

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 (2013) and Part II for these candidates are given above.

D. COMMENTS ON PAPERS AND INDIVIDUAL QUESTIONS

Not relevant for this examination.

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

One candidate was examined who had done the research for the Part II during 2012-13 but had been given an extension to the deadline for submission on the grounds of [redacted]. All relevant evidence was considered in arriving at the agreed mark.

[redacted]	[redacted]	[redacted]	[redacted]

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F. NAMES OF MEMBERS OF THE BOARD OF EXAMINERS

Prof. R.I. Todd (Chairman)	Prof. S.C. Benjamin
Prof. J.T. Czernuszka	Prof. C.R.M. Grovenor
Prof. A.I. Kirkland	Prof. J.M. Smith
Prof. M.G. Burke (external)	Prof. P.D. Haynes (external)

Examination Conventions 2013/14
Materials Science - Final Honours School

1. INTRODUCTION

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 attention of candidates for Part I of the Examination is drawn to key phrases in clauses 5 and 7 of Part A and clause 3 under Part I of Part B of the Special Regulations for the Honour School of Materials Science:

> Part A. 5. 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.
>
> Part 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].
>
> Part 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.

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. Formally, examiners are independent of the Department and of those who lecture courses. However, for written papers on Materials Science in Part I examiners are expected to consult with course lecturers in the process of setting questions. 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 Materials Science Examiners in Trinity 2014 are: Prof. Richard Todd (Chair), Prof. Angus Kirkland, Prof. Chris Grovenor, Dr Jason Smith, Dr Jan Czernuszka and Dr Simon Benjamin. The external examiners are Prof. Grace Burke, University of Manchester, and Prof. Peter Haynes, Imperial College, London.

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

If there are believed to be mitigating circumstances, such as illness, which may have affected the candidate's progress with coursework or performance in a written exam these should be drawn to the attention of the Senior Tutor at the candidate's college as soon as practicable. The Senior Tutor will, if appropriate, inform the Proctors who in turn may communicate with the Chairman of Examiners about the mitigating circumstances. Subject to guidance from the Proctors, if appropriate the Board of Examiners will take into account these mitigating circumstances.

During the marking process the scripts of all *written papers* remain anonymous to the markers.
[In some of the descriptions of marking for individual elements of *coursework* that are given later in this document the term 'double marked, blind,' is used; this refers to the fact that the second marker does not

* for the 2013-14 examinations the Nominating Committee comprised Prof Grovenor & Dr Taylor.

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.]

Procedures covering late submission of or failure to submit/deliver one or more elements of coursework to the Examiners

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); 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 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 of work' clause of the 'Regulations for the Conduct of University Examinations' section of the Examination Regulations (Part 16, 'Marking & Assessment' in the 2013 Regulations).

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

(f) With permission from the Proctors under clause (2) of para 16.8 no penalty.

(g) With permission from the Proctors under clauses (3) or (4) of para 16.8, 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%.

(h) 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.

(i) Where, without the permission of the Proctors under clauses (3) or (4) of para 16.8, 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 Material Science, normally the candidate will have failed Part I or II as appropriate of the Examination as a whole.

(j) Where no work is submitted a mark of zero shall be recorded and, as per the Special Regulations for the Honour School of Material 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 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 Material Science are set out in the MS/MEM FHS Handbook (sections 7 and 10.8 of the 2013/14 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 Material 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.

2. PART I

(1) *Setting of papers*

Part I 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 model answers for every question set. The wording and content of all examination questions set, and the model answers, are scrutinised by all examiners, including, in particular, the external examiners.

(2) *Paper Format*

All General papers comprise eight questions from which candidates attempt five. Each question is worth 20 marks. The total 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 total 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. Marking criteria are given in section 4.

(3) *Marking of papers*

All scripts are double marked, blind, by the setter and the checker. After individual marking the two examiners meet to agree marks question by question. If the differences in marks are 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 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.
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 first five questions in numerical order by question number. 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(2) above will be awarded and (iii) the mark for the paper will still be calculated out of 100.

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 examiner 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 (i) 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.

(4) *Marking of Second Year Practicals for Part I*

Second year practicals are assessed continually by senior demonstrators in the teaching laboratory and in total are allocated 60 marks. Part I examiners have the authority to set a practical examination. 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 section 1 of the present Conventions.

(5) *Marking 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 total 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.

(6) *Marking 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 total 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.

(7) *Marking the 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 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.

(8) Marking the Characterisation of Materials and the 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. The Chairman of 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 50 marks and each of the two reports for the Modelling module are allocated 25 marks. For each module, guidance on the requirements for the reports and an outline marking scheme are published on WebLearn.

3. PART II

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 project is allocated 400 marks, which is one third of the total marks for Parts I and II. 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: 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. An examiners' discussion is held after the viva, involving all Part II examiners, and at which time 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. 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.
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.

If there are believed to be mitigating circumstances, such as illness, which may have affected the candidate's progress with the project these should, in the normal way, be drawn to the attention of the Senior Tutor at the candidate's college, who will, if appropriate, inform the Proctors. The Proctors may in turn communicate with the Chairman of Examiners about the mitigating circumstances. Subject to guidance from the Proctors, if appropriate the Board of Examiners will take into account these mitigating circumstances in their discussion after the viva.

***** 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.

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

4. CLASSIFICATION & MARKING CRITERIA

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

Class I Honours 70 – 100	The candidate shows excellent problem-solving skills and excellent knowledge of the material over a wide range of topics, and is able to use that knowledge innovatively and/or in unfamiliar contexts.
Class Iii Honours 60 – 69	The candidate shows good or very good problem-solving skills, and good or very good knowledge of much of the material over a wide range of topics.
Class IIii Honours 50 – 59	The candidate shows basic problem-solving skills and adequate knowledge of most of the material.
Class III Honours 40 - 49	The candidate shows reasonable understanding of at least part of the basic material and some problem solving skills. Although there may be a few good answers, the majority of answers will contain errors in calculations and/or show incomplete understanding of the topics.
Pass 30 - 39	The candidate shows some limited grasp of basic material over a restricted range of topics, but with large gaps in understanding. There need not be any good quality answers, but there will be indications of some competence.
Fail 0 - 29	The candidate shows inadequate grasp of the basic material. The work is likely to show major misunderstanding and confusion, and/or inaccurate calculations; the answers to most of the questions attempted are likely to be fragmentary only.

In borderline cases the examiners use their discretion and consider the overall quality of the work the candidate has presented for examination. The external examiner often plays a key role in such cases.

Part I:

Unclassified Honours – 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. 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. The examiners do not divide the categories further but tutors and students may infer how well they have done from their marks. 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.

Annex: Summary of marks to be awarded for different components of the MS Final Examination in 2014 (For Part I and Part II students who embarked on the FHS respectively in 2012/13 and 2011/12)

	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 & Industrial visits	80
	Engineering and Society coursework	20
	Team Design Project	50
	Characterisation or Modelling module	50
Part I Total		*800*
Part II	Thesis	400
Overall Total		*1200*

REPORT ON FINAL HONOURS SCHOOL OF MATERIALS 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 in 2011/12 is fewer than six, numerical data are confidential.

Category	Number			Percentage		
	2013/14	2012/13	2011/12	2013/14	2012/13	2011/12
Distinction	n/a	n/a	n/a	n/a	n/a	n/a
Pass	n/a	9	n/a	n/a	100	n/a
Fail	n/a	0	n/a	n/a	0	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 this year.

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

There was some discussion with one of the external examiners as to whether double blind marking was the best and most efficient method of ensuring allocation of the correct marks. This is worthy of discussion.

D. EXAMINATION CONVENTIONS

The previous year's Examination Conventions were included in the Course Handbook that was distributed to all candidates in hard-copy and was also made available on the Departmental website, to which candidates' attention was drawn by e-mail. 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 13 March 2014, and in hard-copy for the start of Trinity term. 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, including the Chairman. Teams were marked as groups. The allocation of bonus or penalty marks is permitted under the Conventions, but was not used. Reports for each of the industrial visits were assessed as pass/fail by the Industrial Visits Organiser, appointed as Assessor.

The overall mean mark for Part I (MS and MEM) was in the middle of the 2(i) band. 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 females and one male. With these small numbers, the breakdown of the results by gender 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

(1) **Breakdown of the results by gender**

	Overall mark		Written Examinations		Coursework	
mark (%)	Male	Female	Male	Female	Male	Female
40–50	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
50–60	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
60–70	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
70–80	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
80–90	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Totals	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

The performance of the male and female candidates was as follows:
Written Papers Averages – [redacted]
Coursework Averages – [redacted]
Overall Part I Averages – [redacted]

F. NAMES OF MEMBERS OF THE BOARD OF EXAMINERS

Prof. R.I. Todd (Chairman)
Prof. S.C. Benjamin
Prof. J.T. Czernuszka
Prof. C.R.M. Grovenor
Prof. A.I. Kirkland
Prof. J.M. Smith
Prof. R. Westbrook (Management)
Dr O. Darbishire (Management)
Dr J. Quah (Economics)
Dr A.W. Beggs (Economics)

Prof. M.G. Burke (External)
Prof. P.D. Haynes (External)
Prof. S.M. Wood (External, Management)
Dr H. Simpson (External, Economics)

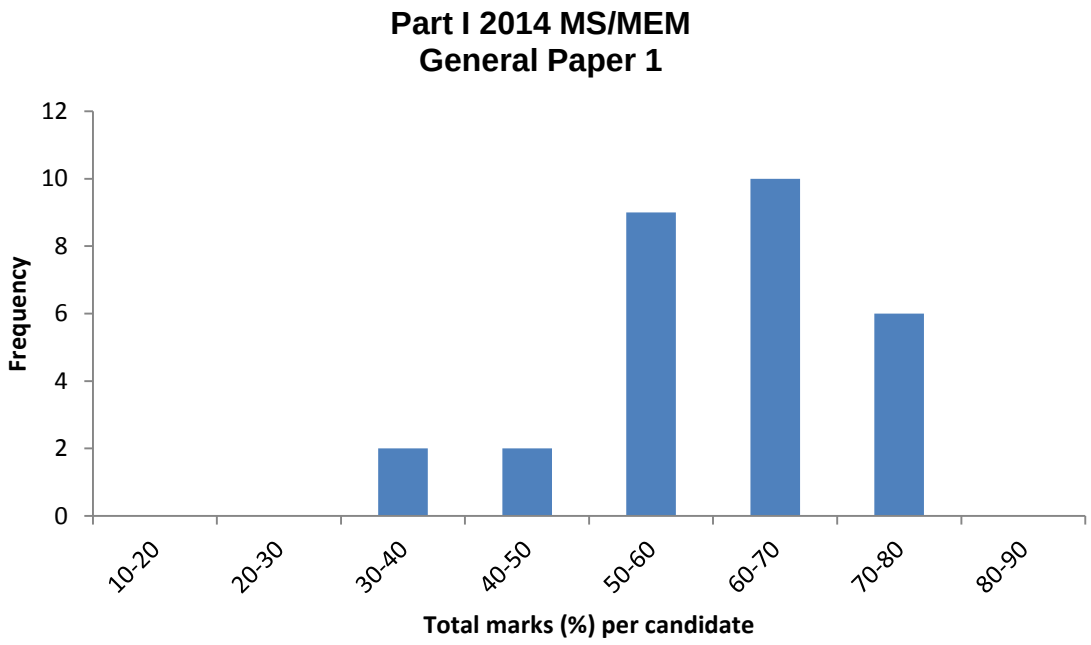
Attachments: Examination Conventions 2013/14 FHS Materials, Economics & Management
Comments on General Paper 1
Comments on General Paper 2
Comments on General Paper 3
Comments on General Paper 4
Comments on Economics papers
Comments on General Management paper

General Paper 1 – Structure and Transformations

Examiner: **Professor Chris Grovenor**
Candidates: **29 (26 MS / 3 MEM)**
Mean mark: **60.72%**
Maximum mark: **75%**
Minimum mark: **38%**

Detailed comments on the paper are as follows:

Question	No of Answers	Average Mark	Highest Mark	Lowest Mark	Topic
1	18	10.78	13	8.5	Corrosion (Pourbaix Diagram)
2	27	13.28	17.5	4	Corrosion (Passivity)
3	22	12.20	17.5	2	Diffusion
4	15	10.70	15	5	Surfaces and Interfaces
5	24	14.02	19	5.5	Nucleation
6	18	12.44	18.5	6	Ternary Phase diagrams
7	11	9.41	14	6	Powder Metallurgy
8	10	11.00	14	7	Polymer and dendrite shapes



General Comments:

The general performance of the candidates on this paper was quite good, and the marks spread suggested that it stretched the weaker candidates while allowing the stronger ones to perform well. Even the less popular questions (7 and 8) were chosen by at least 10 candidates. The paper average was within the target range.

Question 1. A very standard question on constructing a Pourbaix Diagram from data given in the question. A relatively low average mark because of the rather poor attempts at part b)

d) and d) Most candidates could describe the basic features of a Pourbaix Diagram well.

e) Few made a good attempt at constructing the diagram, with a variety of numerical mistakes and incorrectly balanced equations.

f) Without a good attempt at b), it was hard for candidates to achieve many marks on this part.

Question 2. A very popular question and rather well answered in general. The candidates were invited to show what they knew about passivation, and could mostly show some detailed understanding.

d) On the basic process of passivation, and generally well answered.

e) It was surprising that not all the candidates could state which common metals are protected by passive layers nor define the passivating phase formed.

f) Many candidates, but by no means all, could construct a simple Evans diagram.

Question 3. Another popular question on interstitial and isotopic diffusion.

d) Most candidates could define why diffusion in ceramics is generally slow.

e) Candidates fell into 2 camps – those who could with confidence discuss the equations governing interstitial diffusion, and those who did not attempt this part.

f) Parts (i) and (ii) done well by almost all, but some did not know that the error function was the appropriate solution to Fick II in (iii). The very simple calculation in (iv) required knowing the approximation for using the error function, and by no means all candidates did.

Question 4. Surfaces and Interfaces question that examined part of the course that is not often asked, which perhaps explains why the average mark is low.

c) Many could describe surface reconstruction, but some of the techniques selected to study this phenomenon were surprising.

d) This part of the question was on solute enrichment factors, and while some candidates were confident in describing the thermodynamic basis for different behaviours others had only the haziest understanding of what governs solubility in an alloy system.

Question 5. A popular question on precipitation that was generally very well answered.

d) The sequence of stages in a typical precipitation reaction was explained clearly by most candidates.

e) This part on the equation for nucleation rate was the least well answered, with some wooly definitions of the parameters and their physical meaning.

f) Many candidates had a good grasp of nucleation in the eutectoid transformation.

Question 6. A slightly non-standard ternary phase diagram question in that it involved a ternary peritectic reaction. Many candidates constructed the isothermal section very well, making the correct decisions on the sequence of reactions apparently without difficulty.

d) It was disappointing that some candidates could not construct a binary phase diagram from the data given in the question – something they should have been able to do in the first year.

e) Those that could do the isothermal section scored very well, but some candidates made no serious attempt at this part.

f) Unless b) was done well, this part was not possible, but even those who had successfully completed the isothermal section made some curious choices made about the path of the reactions.

Question 7. Relatively unpopular bookwork powder metallurgy question until the final part which introduced a calculation from the Phase Transformations course.

b) Even though parts a) and b) required little more than a clear summary of material covered in detail in the handouts, few candidates were able to score very well.

d) This part required the candidates to use an equation from the Phase Transformations course, and almost no candidates were able to see that this is what was required.

Question 8. A question that combined the thermodynamic background to microstructure in polymers and dendritic growth. Rather unpopular and not very well answered.

c) Most candidates performed better at this part of the question than part b, and were able to describe lamellar polymer crystals with some confidence.

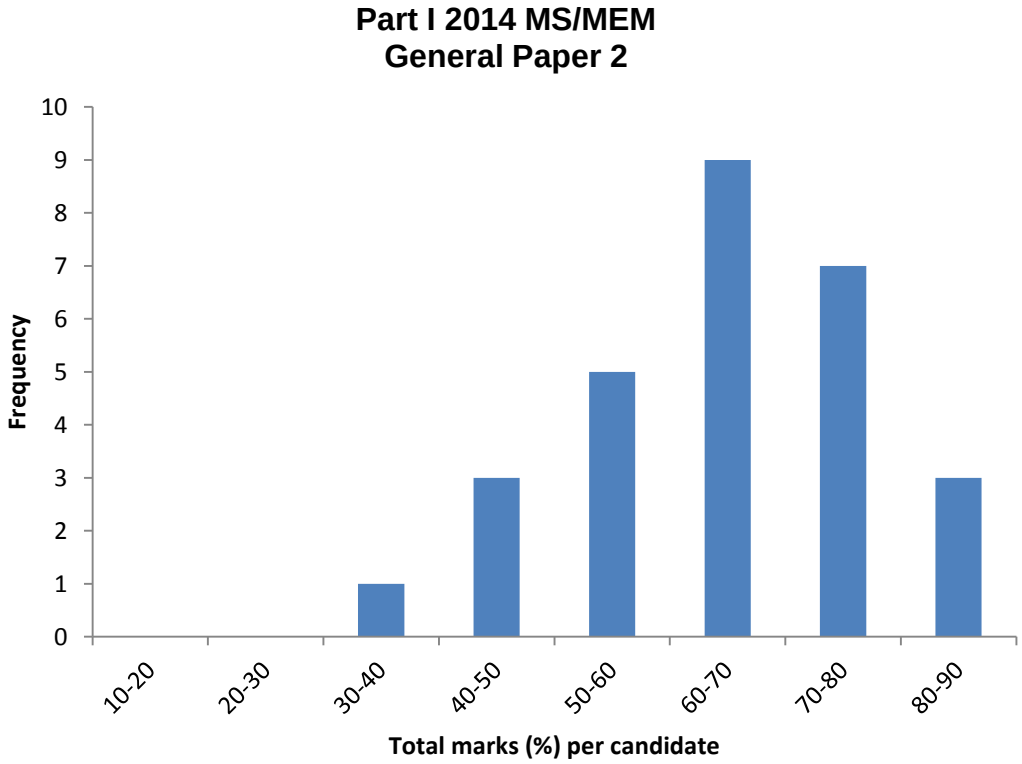
d) Bookwork explanation for the balance of thermodynamics and kinetics in dendritic growth, but not attempted well by most candidates.

General Paper 2 – Electronic Properties of Materials

Examiner: **Professor Jason Smith**
Candidates: **29 (26 MS / 3 MEM)**
Mean mark: **66.28%**
Maximum mark: **93%**
Minimum mark: **40%**

Detailed comments on the paper are as follows:

Question	No of Answers	Average Mark	Highest Mark	Lowest Mark	Topic
1	28	12.95	18	6	Quantum Mechanics
2	26	14.90	19.5	6	Statistical Mechanics
3	19	13.00	18.5	2	Electronic Structure of Materials
4	14	13.50	18.5	8.5	Semiconductor Materials
5	5	9.90	13	7	Electrical & Optical Properties
6	12	14.21	18.5	4	Electrical & Optical Properties
7	16	14.63	17.5	11.5	Magnetic Properties
8	25	10.92	17.5	5.5	Tensor Properties of Materials



Detailed comments:

1) Quantum mechanics.
The most popular question on the paper and generally well done. Some students struggled a bit with change of axis range for the square well potential compared to that used in the lectures, but several navigated this well. Only a few were able to make a convincing argument for the general solution in b(ii), and most substituted back in to show that it was a solution, for which partial marks were awarded.

2) Statistical mechanics.
Another very popular question, also answered well. Good general appreciation of the basics of statistical mechanics and relationship to second law. Most students were also able to demonstrate understanding of the use of the partition function by correctly setting up the 'three level system' which had not been covered explicitly in lectures, and derive the paramagnetic susceptibility.

3) Electronic Structure of Materials.
Attempted by about 2/3 of candidates, with quite good answers. Part a generally well done, but with a few sloppy answers in which definitions of valence and conduction bands were specific to metals. Several struggled with sketching the band structure in part (b), but once this was in place were able to complete the question. Nearly all were able to distinguish accurately between direct and indirect band gaps. Differentiation of trig functions to get to effective mass in part b(v) was frequently poor and relatively few obtained the correct numerical answers.

4) Semiconductor Materials.
Attempted by half the candidates, with a good range of answers. Surprisingly few could list the four materials in order of increasing band gap in part (a). Most had a good sense of the distinction between intrinsic and extrinsic behaviour but some answers were poorly worded and not many made the link between a narrow gap and dominant intrinsic behaviour. Parts (b) and (c) were generally done quite well, although clearly in some cases reliance on memory of graphs in part (c) provided a poor substitute for clear understanding.

5) Electronic and Optical Properties of Materials. The least popular question with only five attempts, and generally poorly done. A couple of students misread part (a) and gave detailed explanations of optical polarisation mechanisms rather than electrical polarisation mechanisms, thus losing a lot of marks and lowering the average. Part (b) was generally well done. Part (c) was found challenging though, and most students were not able to identify the Brewster criterion from the Fresnel equations. No correct answers to c(iii).

6) Electrical and Optical Properties of Materials.
A question on piezo/pyro/ferroelectricity attempted by just under half of the students and reasonably well done overall. Most students were able to define the three phenomena accurately with some grasp of the requirements placed on crystal structure. Many were able to identify that hBN should be piezoelectric but graphene not, and neither should be pyroelectric. Several correct answers were given to the numerical question in part (c).

7) Magnetic properties of materials.
Attempted by about 40% of candidates and reasonably well done. Most could place the four parameters on a hysteresis curve and give reasonable definitions in part (a), although permeability was often confused for susceptibility. Part (b) produced some good descriptions of combinations of parameters needed for different applications. Most struggled with the calculation in part (c), and only one candidate produced a well-supported answer for the power required to drive the electromagnet.

8) Tensor properties of materials.
A very popular question, but generally done quite poorly. In part (a), nearly all students knew that tensors were used for anisotropic properties, but many did not explain how the representation works as requested. Several gave stress or strain as an example of a matter tensor. For part (b) there were some good answers, although several students discussed the symmetry axes of crystals rather than the principal axes of the properties being described. Most struggled with part (c), the most common mistakes being losing track of axes, rotating by 45 degrees from [001] to [101] despite the tetragonal lattice structure, and using incorrect equations for the relationship between the electric field and the polarisation.

General Comments:

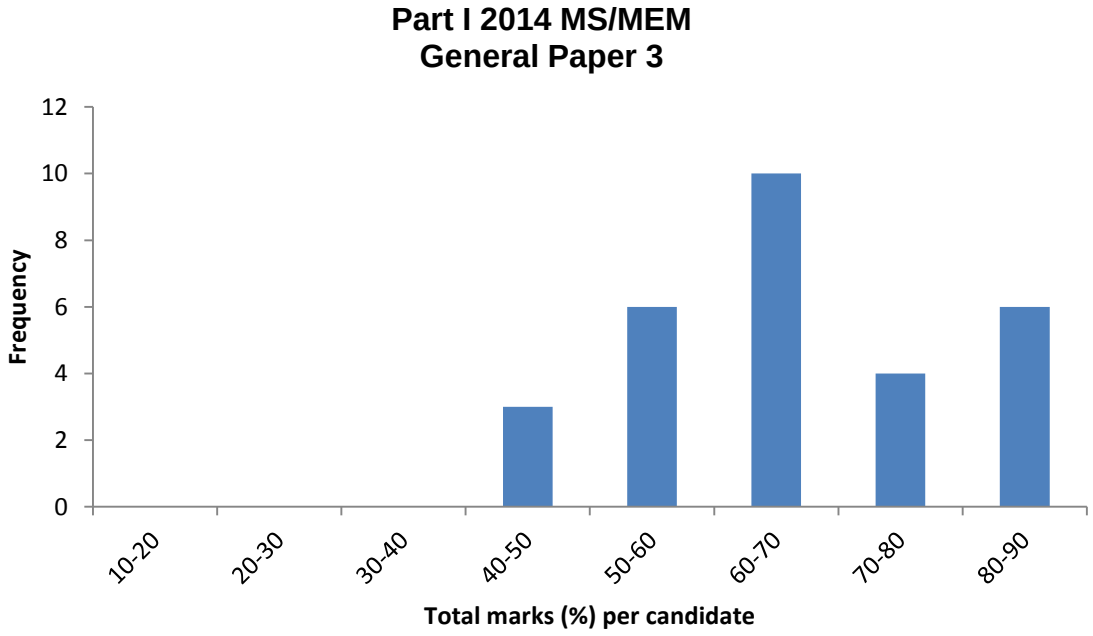
The paper produced quite a wide spread of marks, with a few very high scores and several quite low ones, and a mean mark of 66.28%. All candidates attempted five questions, and all candidates achieved a mark of 40% or higher. The most popular questions were on quantum mechanics, statistical mechanics and tensor properties, and the least popular was a question on the optical properties of materials. The better candidates showed good understanding in the questions they attempted, and were able to apply their knowledge and problem-solving skills to unfamiliar scenarios and extract quantitative answers. Poorer candidates relied heavily on memorising facts and figures and were less able to cope with nuanced questions or problems that differed from those covered explicitly in the lectures or tutorial sheets.

General Paper 3 – Mechanical Properties

Examiner: **Professor Richard Todd**
Candidates: **29 (26 MS / 3 MEM)**
Mean mark: **67.14%**
Maximum mark: **90%**
Minimum mark: **41%**

Detailed comments on the paper are as follows:

Question	No of Answers	Average Mark	Highest Mark	Lowest Mark	Topic
1	19	11.63	17.5	6	
2	19	14.32	18	9	
3	19	14.34	19.5	5.5	
4	12	15.17	19.5	8.5	
5	25	12.12	17	3	
6	13	11.23	19	3	
7	14	12.54	16.5	6.5	
8	24	15.35	19.5	2	



General Comments

The overall marks are satisfactory: all candidates achieved over 40% and the mean mark was at the high end of the 2(i) classification range. The significant number of students achieving marks in the range 80-90% demonstrates that the questions were fair. All questions were attempted by over a third of the cohort. Those questions with lower mean marks (e.g. 1 and 6) had a bimodal marks distribution, with very high marks for students who were familiar with the area examined by the question and low marks for some students who simply did not know the basics. The satisfactory overall marks distribution suggests that these questions were the "last choice" of the weaker candidates.

Comments on Individual Questions

Q1. Strongly bimodal marks distribution with six 1st class marks, eight 3rd or fails and only three marks in the 2.1/2.2 range. This was apparently because of the strong bookwork content of the question: candidates who knew the material scored highly but about half of those attempting the question simply did not know much about this area.

Q2. Discursive question with some very good answers. Some weaker candidates misinterpreted part (b) as requiring answers for different types of polymer (amorphous, necking, thermoplastic) but managed to pick up some marks despite this. Not many candidates really made the most of the main "novel" part of the question, which was to contrast the behaviour of polymers with that of metals.

Q3. Mathematical question in which the majority of candidates scored 1st class marks, several with 19 or 20. The minority with low marks tended to lose marks primarily through not understanding or knowing about this area rather than any lack of mathematical ability.

Q4. Less popular question, possibly because it was a slightly different format to previous years. The majority of candidates who attempted it got first class marks, several with 19 or 20. The few candidates with low marks did not know basic definitions such as the Burgers circuit sufficiently rigorously.

Q5. Very popular question on age hardening. Most candidates knew the gist of the arguments but few were familiar with the details. Nevertheless, the modal score was in the 2.1 bracket and a comfortable majority scored 2.1 or 1st class marks.

Q6. Unpopular question with very bimodal marks distribution. Around half of those answering the question had evidently chosen it on the basis that they understood the subject matter and scored highly. The other half did not have sufficient knowledge to pick up many marks.

Q7. The majority of candidates scored a 1st class or 2.1 mark on this and parts (a) and (c) were generally done well by most, although several candidates failed to use a value for the indentation load appropriate to its units (N). However, few candidates could describe the origin of the test (part (b)) in much detail.

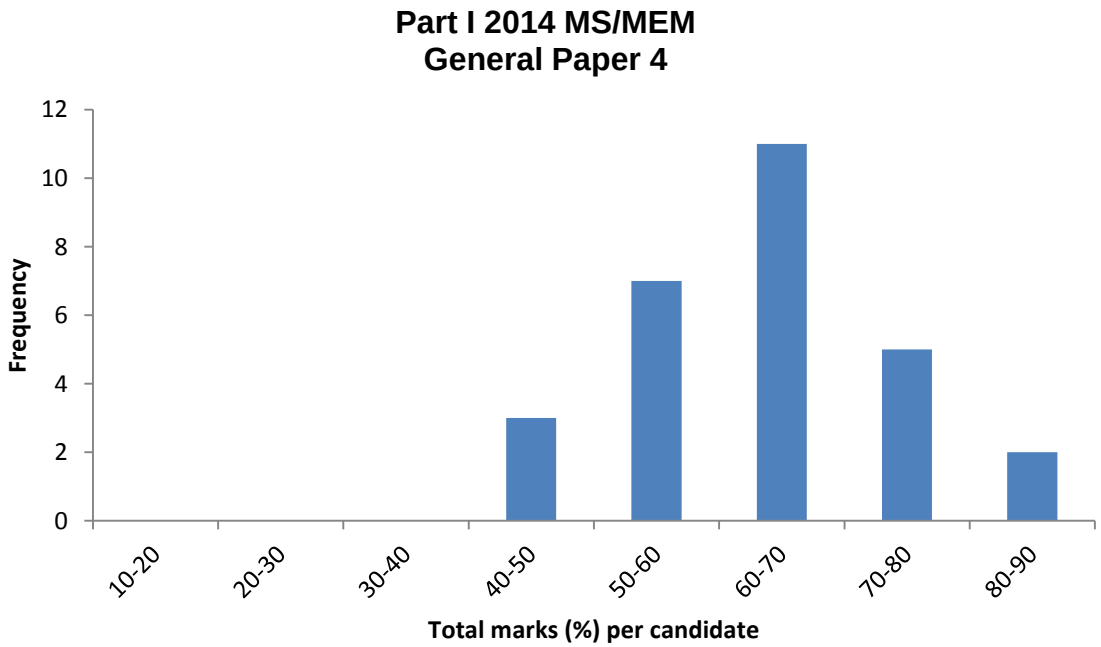
Q8. Straightforward question with main points captured by the majority of candidates.

General Paper 4 – Engineering Applications of Materials

Examiner: **Professor Jan Czernuszka**
Candidates: **29 (26 MS / 3 MEM)**
Mean mark: **65.28%**
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	9	12.17	15.5	9	Polymers
2	25	13.60	19.5	4	Microstructural characterisation
3	16	12.66	18.5	1	Microstructural characterisation
4	23	12.04	18.5	3.5	Ceramics and glasses
5	25	15.94	19.5	11	Ceramics and glasses
6	16	11.22	17	4	Semiconductor Devices
7	14	10.61	17	6.5	Engineering Alloys
8	17	13.47	18.5	7	Engineering Alloys



General Comments

Overall, the standard was high with some very high scores that were pleasing to mark.

Question 1 Polymers

An unpopular question. Part (a) and (b) on semiconducting polymers – generally well answered; parts (c) and (d) on ionic polymers that was less well answered. Candidates lost marks by confusing ionic and semiconducting polymers.

Question 2 Microscopies

A popular question. Parts (a) and (b) were generally well answered and candidates understood the main aspects. Part (c) led to some confusion and most marks were lost here.

Question 3 Electron diffraction

A straightforward question on diffraction contrast and diffraction patterns. Most candidates answered this question well with some very high marks. Most marks were lost in (c) part iii).

Question 4 Disorder in ceramics

A popular question. A question on Frenkel and Schottky defects in ceramics. Most candidates answered parts (a) and (b) well. Marks were lost in (c) by candidates not describing the various mechanisms of unbalanced defects.

Question 5 Sintering

A popular question. General question on different types of sintering. Some exceptionally good answers. Marks were lost in part (c) by using incorrect processing routes.

Question 6 Diodes

Part (c) caused the most difficulty especially when dealing with the materials aspects of the devices.

Question 7 Superalloys

A reasonable spread of marks with a low mean. A general discussion about superalloys in the first part with a simple substitution and integration in the mathematical part. There was an error in the equation in the examination script, with an incorrect subscript on a variable. This made the final part of the question impossible to complete, as was recognised by the examiners during the marking process. The two examiners took this error into account, marking generously when candidates were able to show progress in setting up the problem mathematically. As there was no evidence that the errors influenced the candidates' choice of question, it was proposed that this allowance be considered sufficient, and this approach was endorsed by the external examiners.

Question 8 Al alloys

A 3-part question. The first part was a general introduction to alloy strengthening. The second part required analysis of data on age hardening. The third part was a numerical question/estimate. Part (c) seemed to have the lowest marks.

Examiners' Report for MEM 2014 – Economics Papers

Part I

3 candidates sat the *Introductory Economics* paper (compared to 9 the previous year) in 2013. The paper is also taken by as Prelims paper by PPE and E&M candidates and a detailed report can be found in the 2013 PPE examiners' report. MEM scripts were double marked.

The candidates sat the *Microeconomics* paper in 2014. The paper was identical to the Finals' paper sat by E&M and PPE candidates. A detailed report can be found in the PPE Finals' examiners report (see link below).

https://weblearn.ox.ac.uk/portal/hierarchy/socsci/econ/curr_student/undergrad/examinations/page/home

Alan Beggs

John Quah

Examiners' Report for MEM 2014 – Management Papers

Examination Report
General Management
Trinity Term 2014

General comments

The examiners were, for the most part, pleased with the quality of the scripts and particularly with the breadth of the questions that students attempted to answer. The majority of students achieved a 2.1 result and some very good students achieved firsts on both the individual answers and a First overall. We were clear that most students (with a few notable exceptions) had been diligent in preparing for tutorials and doing the reading for the course and it showed in their answers to the prelims examination.

If there was one disappointment, it was that students were not always well organized in the essays that they wrote during the exams. While it is understandable that the examination pressure makes students less organised, it is important to be direct and answer the question as soon as you can – don't simply say that you will answer the question! And while it isn't always necessary to have precise citations or exactly the right example to support each point, the best answers used both theory and examples (and not just from the lectures or reading) to make their point. As always, twisting a question so that it mimicked a tutorial essay question was a bad strategy – it is best to treat each exam question as a new question that needs to be rethought in the light of the exam and not simply as an excuse to trot out an old answer.

In general, the examiners were pleased with the quality of the scripts and we were satisfied that the students had achieved their learning objectives in General Management. We believe that the first year course continues to achieve its intended objectives of providing a solid base for the specialized courses in the subsequent years and broad synthesis of classic management theory that will be helpful to the students in the years to come. It is also clear that the preliminary examination is useful in integrating the materials that the students have been taught and helping them to see the connections among and between the various modules.

Specific questions

1. (Power Outside the Firm)

(Number answering = 22) Although a great number of students answered this question, many did so without being very clear about the underlying question – just what constitutes the true boundaries of the firm? How does one practically describe an apparently arbitrary distinction? The best answers from students were sophisticated in defining the shifting boundaries and the ability of executives to span those supposed limits.

2. (Responding to the Kindle)

(Number answering = 17) Not the most popular question, those students who did try to answer the question were somewhat unclear about the structure of publishing itself – often unaware that publishers don't need to print books on paper but could create electronic books themselves. The changing structure of the publishing industry is a good example of how the value chain of an industry can change as competition erupts not simply within one part of the value chain but across the entire industry through technological change and changing consumer tastes.

3. (4P's Obsolete?)

(Number answering = 27) A popular question, students were equally well served arguing that the "4P's" are timeless or that technological change via the Internet has made them obsolete. The best answers, however, were particularly clear about how the internet differs from preceding technologies and in those ways that it has fundamentally changed the economics of retailing.

4. (Professionals Losing Status)

(Number answering = 6) One of the least common questions chosen, the best answers spoke of changing cultural norms, shifting technologies, and even the gendering of occupations.

5. (Seasonal Goods in Supply Chains)

(Number answering = 8) An interesting, if tricky question, the best answers described how one manages goods that don't have steady monthly demand. Interestingly, the best answers demonstrated that this is not reserved simply to holiday gifts but also to professional services (tax preparation), transportation (holiday cruises), and sports equipment (snowboards).

6. (Global Companies Replacing Multi-domestic)

(Number answering = 6) Very few students answered this question, although the few that did were able to show how much they knew about the two types of companies – where global companies produce homogenous goods for global demand (Boeing or Apple) and multi-domestics specifically produce particular variants for local needs (Phillips light-bulbs or advertising agency advertisements).

7. (The Boundaries of the Firm)

(Number answering = 14) Like the first question in this section, this question required students to both provide specific examples of the boundaries of the firm and to also explain the relevant theory behind those demarcations. The best answers described the shifting boundaries of firms over time and across national boundaries.

8. (Management's Scientific Rigour)
(Number answering = 32) This was a fairly popular question, most likely because students had seen a variant of it in their tutorial essays. The best answers used theory from the philosophy of science (including Popper) to think through the "scientism" of management. It was also helpful to frame management as a social science and the expectations that result from its inherent pragmatism.

9. (Using Culture as a Strategy)

(Number answering = 52) The single most popular question, students were quick to argue that strategy was not simply a resource but an advantageous ideology. The very best answers drew on examples outside of the lectures and used insights from anthropology and organizational behavior in addition to strategic management.

10. (History is Bunk?)

(Number answering = 22) Not surprisingly, most people disagreed with Ford (so did Ford, who created his own museum dedicated to the history of technology). The best examples explained what insights might come from seeing patterns in previous technological and cultural changes.

11. (Managing Oxford's Brand)

(Number answering = 13) Not the most popular question, students generally saw Oxford as managing its own brand fairly well but conceded that there we complications arising from its many divisions and complicated, decentralised structure.

12. (Leadership Substituting for Strategy)

(Number answering = 22) A fairly popular question, people generally disagreed with the assertion, choosing a middle ground that both were necessary. The interesting question, that only a few touched upon, is whether a strategy can ever be so good that it can stand-in for leadership – that seems unlikely as well.

PART B

13. (Corporate Governance in Culture)

(Number answering = 34) This question was among the most popular questions but the crucial element in the question was to notice that causality ran from corporate governance to culture, not the other way. In particular, the best answers described how governance structures corporate culture and how particular forms of corporate governance affect the development and implementation of culture in organisations.

14. (Internationalizing Products or Services)

(Number answering = 36) Another popular question, students were generally right that goods and services require different supply chains, organizational capabilities, and modes of entry. That said, the most interesting answers showed not only the differences but also the similarities between goods and services in the international economy.

15. (Facebook's Supply Chain)

(Number answering = 7) One of the least answered questions, students were rightly wary of this question since it required them to think through exactly what Facebook's product really is and how it supplies that product.

16. (Duty to Pay Equitable Wage)

(Number answering = 27) A reasonable number of students attempted this question often blending the work on international labour markets with the moral imperatives of capitalism.

17. (Principal Agent Problem is Power)

(Number answering = 33) A very popular question, students often combined what they knew from Lukes with the principals agent economics. The most thoughtful answers acknowledged both the presence of power in almost all negotiations and the legitimate debates about how best to structure principal agent interactions.

18. (Amazon's Pricing Power)

(Number answering = 26) A popular question, the reality that Amazon often charges more runs against the early expectation that websites would have little pricing power given the ease with which price comparisons can be made. One important element, of course, is whether Amazon offers superior service – either through ease of use, superior logistics, or simply corporate reputation – than its rivals and thus deserves a price premium.

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 in previous years is fewer than six, numerical data are confidential (see section E, below).

Class	Number			Percentage (%)		
	2013/14	2012/13	2011/12	2013/14	2012/13	2011/12
I	1	n/a	n/a	11.11	n/a	n/a
II.I	7	n/a	n/a	77.78	n/a	n/a
II.II	1	n/a	n/a	11.11	n/a	n/a
III	-	n/a	n/a	0	n/a	n/a
Pass	0	n/a	n/a	0	n/a	n/a
Fail	0	n/a	n/a	0	n/a	n/a
Total	9	27	22	-	-	-

(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 this year.

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

There was some discussion with one of the external examiners as to whether double blind marking was the best and most efficient method of ensuring allocation of the correct marks. This is worthy of discussion.

D. EXAMINATION CONVENTIONS

The previous year's Examination Conventions were included in the Course Handbook that was distributed to all candidates in hard-copy and was also made available on the Departmental website, to which candidates' attention was drawn by e-mail. 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 13 March 2014, and in hard-copy for the start of Trinity term. 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 nine candidates 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

For reasons of anonymity, the details of the overall mean marks are discussed in this section. For Parts I and II combined the average mark was in the mid 2(i) range.

(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. There were nine candidates, all of whom were awarded Honours, with one in each of the 1st and 3rd class categories and seven in the 2(i) category.

Class	Number			Percentage (%)		
	2013/14	2012/13	2011/12	2013/14	2012/13	2011/12
I	1	0	2	11.11	0	33
II.I	7	1	4	77.78	100	66
II.II	1	0	0	11.11	0	0
III	-	0	0	0	0	0
Pass	0	0	0	0	0	0
Fail	0	0	0	0		0

(2) **Breakdown of the results by gender**

	Overall mark		Part 2 Mark		Part 1 Mark	
mark (%)	Male	Female	Male	Female	Male	Female
0 - 40	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
40–50	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
50–60	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
60–70	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
70–80	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
80–90	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Totals	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

(3) **Candidates' Performance in each part of the examination**

All candidates sat the Materials Options paper, for which the mean mark (MEM only) was 60.67%. In addition, six candidates sat the Finance paper, achieving an average of 66.5%, whilst the other three candidates sat the Game Theory paper, achieving an average of 59.33%.

(4) **Equal Opportunities issues**
Insofar as can be judged from the small sample size, the performance of male and female candidates was not significantly different.

If necessary, where approved by the Proctors, the Examiners took into account the impact of dyslexia and other specific learning difficulties and/or other special arrangements. These allowances seemed satisfactory.

F. NAMES OF MEMBERS OF THE BOARD OF EXAMINERS

Prof. R.I. Todd (Chairman)

Prof. S.C. Benjamin

Prof. J.T. Czernuszka

Prof. C.R.M. Grovenor

Prof. A.I. Kirkland

Prof. J.M. Smith

Prof. R. Westbrook (Management)

Dr O. Darbishire (Management)

Dr J. Quah (Economics)

Dr A.W. Beggs (Economics)

Prof. M.G. Burke (External)

Prof. P.D. Haynes (External)

Prof. S.M. Wood (External, Management)

Dr H. Simpson (External, Economics)

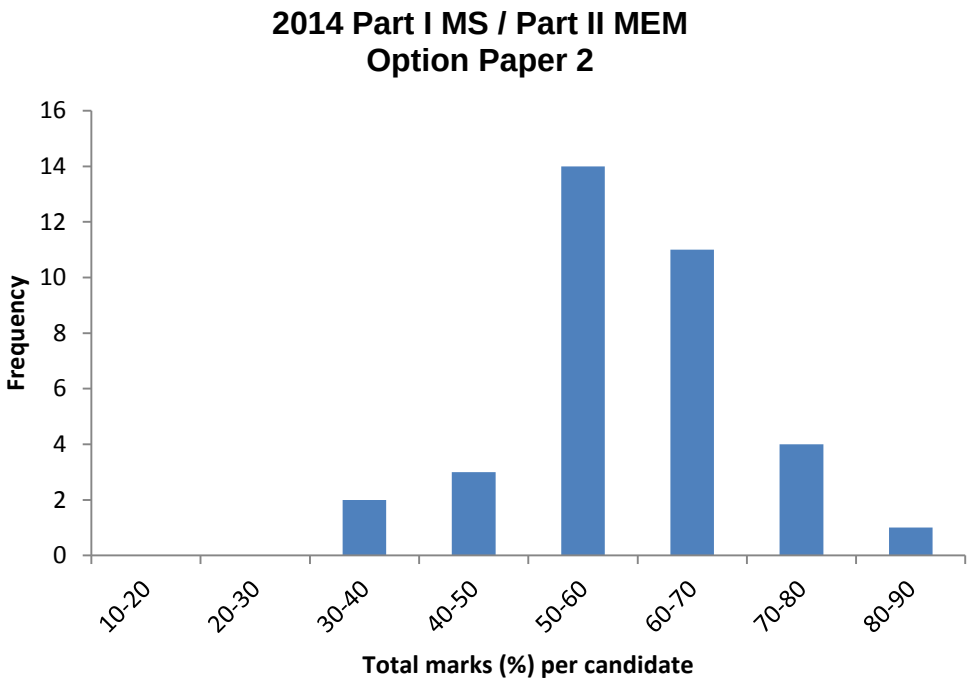
Attachments: Examination Conventions 2013/14
Comments on Materials Option Paper 2
Comments on Economics paper

Materials Options Paper 2

Examiner: **Professor Simon Benjamin**
Candidates: **35 (26 MS / 9 MEM)**
Mean mark: **59.11%**
Maximum mark: **82%**
Minimum mark: **33%**

Detailed comments on the paper are as follows:

Question	No of Answers	Average Mark	Highest Mark	Lowest Mark	Topic
1	13	15.65	21.5	9	Polymer blends and copolymers
2	11	15.18	18	11.5	Recycling plastics & SANS experiments
3	18	14.28	22	6.5	Processing of steels
4	25	14.62	22	4.4	Eutectic alloys and melt processing
5	4	9.13	15.5	3.5	Energy production, distribution & storage
6	9	15.11	21.5	10.5	Fuel cells, hydrogen production & heat exchangers
7	4	16.25	21	10.5	Spinodal reactions
8	8	14.81	21	5.5	NiAl intermetallics
9	19	13.76	19.5	7.5	Biomaterials and bioreactivity
10	18	15.78	22.5	6	Bioresorbable and bioinert polymers
11	7	14.29	19.5	9.5	Electroceramics
12	4	16.63	20.5	13	Magnetic properties, magnetoresistance & magnetic hysteresis curves



General Comments

SECTION A ADVANCED POLYMERS

1) A popular question on polymer blends and copolymers. (a) Most candidates correct distinguished the key distinguishing features. (b) Most candidates demonstrated reasonable understanding of the principle of mixing in the presence of a solvent; some would have benefitted from a more careful reference to entropy. (c) Sketches of morphology changes were generally good, with reasonable accompanying explanations. Not all candidates paid attention to the instruction, "In your answer, consider how this compares with metal alloys." (d) On control via processing parameters was generally not well answered with several candidates not understanding what was meant by "processing parameters". (e) On differing morphologies and consequent properties: Most candidates able to gain some marks here but few able to say enough for full marks.

2) A four part question divided into two halves, (a) and (b) on recycling plastics, and (c) and (d) on SANS experiments. (a) On use of products beyond 'first-life' was well answered with the majority of candidates able to gain most or all marks available. (b) On the origin and consequences of poor mixing in recycled plastics – moderately well answered with most candidates able to make some useful remarks. (c) Requiring candidates to consider a SANS experiment and identify which mix would give a contrast match – generally well answered, although some candidates confused by the easy nature of the question and seeking to perform more elaborate analysis. (d) On surveying different plot types – almost all candidates were able to name and describe one or two types, and several candidates able to describe a full set of four.

SECTION B ADVANCED MANUFACTURE WITH METALS AND ALLOYS: PROCESSING, JOINING AND SHAPING

3) A question on the processing of steels. Most candidates were able to sketch the casting arrangement for continuous and twin roll casting in part (a). A wide range of answers were given in part (b) comparing solidification conditions, with only a few relating that size of microstructure to the cooling speed. Generally good answers to part (c) on the economic and technical benefits of the two methods. Parts (d) and (e) on joining and corrosion protection were generally well done.

4) A popular question with 25 attempts. Question had 5 parts. (a) On near eutectic alloys: generally well answered with appropriate diagrams. (b) On squeeze casting: well answered except that for a few candidates who simply did not know what squeeze casting is. (c) On melt-processing: Not well answered in general, several candidates described the use of Si instead of SiC. (d) On the problems of joining these materials – most candidates have some correct remarks to make. (e) generally well answered with the stronger candidates describing both pros and cons.

SECTION C
MATERIALS FOR ENERGY PRODUCTION, DISTRIBUTION AND STORAGE

5) The question with the lowest average mark in the exam, and one of the least popular. Of the 4 attempts, 2 were reasonable, but 2 were very poor. The question had 3 parts. Part (a) asked about factors that "influence the average annual power output" of various kinds of power station. Generally candidates did not focus on the factors affecting the amount of time a system can be active (as the question setter intended) but rather gave factors affecting instantaneous power output. However since the question did not make the context completely clear, these answers were accepted. Part (b) concerned fast breeders, with some reasonable responses. Part (c) concerned the Chernobyl disaster; no comprehensive answer was produced but some relevant factors were identified. One candidate concluded their analysis with " …thus leading to meltdown :(" using a sad-smiley as a compact way to articulate the tragedy of a region becoming irradiated and uninhabitable for 20,000 years.

6) A three part question on fuel cells, hydrogen production and heat exchangers. The first part concerning fuel cells was well answered, with candidates reproducing the figure from the lecture notes with good explanations. The second part on hydrogen production also generally received good answers. The third part was a calculation relating to thermal change in a heat exchanger – the analytic part of the calculation was not well attempted with only one candidate producing an approximately correct answer. It should be noted that there was an error in the question itself for the very last 2 marks – candidates were asked to put numbers into their derived formula but in fact the set of parameters given was not sufficient to evaluate the quantity. Only a few candidates reached

that stage of the question, and the examiners decided to grade those efforts in such a way that any reasonable attempt that the last part would be generously marked.

SECTION D
ADVANCED ENGINEERING ALLOYS AND COMPOSITES

7) Spinodal reactions. Most candidates understood the basic concept quite well, both in terms of observed phenomena and underlying physical mechanism. Variable answers to part (c) distinguishing coherent and chemical spinodal, and outlining the Cahn Hilliard model. Some answers to the latter were very detailed and few were able to pick out the key points in an efficient way.

8) A question on NiAl intermetallics, generally well answered. Most candidates knew the crystal structures and made good attempts at describing the active slip systems, although many struggled to identify the key elements of the dislocation motion that determined the mechanical properties. For part (c) however, most candidates were able to identify hydrogen embrittlement at grain boundaries as the principal mechanism for low ductility in polycrystalline Ni3Al.

SECTION E
BIOMATERIALS AND NATURAL MATERIALS

9) Biomaterials and bioreactivity. Popular and generally well done. Parts (a) and (b) on the bioreactivity spectrum and attachment of ceramic bone substitute to a host bone were well answered. Part (c) elicited slightly more variable quality of answer as it required a deeper understanding of the mechanisms for increased resorption.

10) Part (a) was on the relative merits of bioresorbable and bioinert polymers for a variety of biomedical procedures and replacement parts. This was generally very well done, although some candidates struggled to articulate clearly the main reasons for choices made, possibly relying heavily on memory of notes. Part (b) on collagen was generally well done.

SECTION F
DEVICES, MEMORY AND STORAGE

11) Electroceramics. Answers to part (a) on domains and poling were variable with several candidates confusing domain formation in ferroelectrics with that observed in ferromagnets. Part (b) on controlling the temperature dependence of permittivity in barium titanate by shifting and broadening the resonance with doping, and part (c) on lambda sensors, were bookwork and generally well done.

Overall I would say that the balance between knowledge and understanding is broadly as expected. Most candidates showed a good knowledge of the subject matter, and the better candidates showed that they understood the principles behind the facts and could produce well-reasoned answers.

12) An unpopular question with only 4 attempts. The question is in three parts, with the first two parts concerning the origins of magnetic properties, and the phenomena of giant magnetoresistance and tunnelling magnetoresistance. This was generally well answered with candidates reproducing standard explanations with diagrams, etc. as one would find in a textbook. The last part of the question concerns the use of the Stoner-Wohlfarth to obtain simple magnetic hysteresis curves. Here the candidates demonstrated a general sense of what they were supposed to do and the results that should be obtained, but in terms of the step by step analysis there was some broken logic and confusion.

Examiners' Report for MEM 2014 – Economics Papers

Part II

Four papers were available to Part II candidates: Macroeconomics, Econometrics, Microeconomic Theory and Game Theory. 3 MEM candidates sat Game Theory but no other papers were taken. A detailed report can be found in the PPE Finals' examiners report (see link below).

https://weblearn.ox.ac.uk/portal/hierarchy/socsci/econ/curr_student/undergrad/examinations/page/home

Alan Beggs

Examination Conventions 2013/14
Materials, Economics and Management - Final Honours School

1. INTRODUCTION

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

> Part 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.
>
> Part 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].
>
> Part B. Part I. 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.

The examiners are nominated by the Nominating Committee* in the Department of Materials and those nominations are submitted for approval by the Vice-Chancellor and the Proctors. Formally, examiners are independent of the Department and of those who lecture courses. However, for written papers on Materials Science in Part I and Part II, examiners are expected to consult with course lecturers in the process of setting questions. 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 E(M)EM Standing Committee, 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 Science Examiners in Trinity 2014 are: Prof. Richard Todd (Chair), Prof. Angus Kirkland, Prof. Chris Grovenor, Dr Jason Smith, Dr Jan Czernuszka and Dr Simon Benjamin. The external examiners are Prof. Grace Burke, University of Manchester, and Prof. Peter Haynes, Imperial College, London.
The Materials, Economics and Management Examiners in Trinity 2014 are: Prof. Richard Todd (Chair), Prof. Angus Kirkland, Prof. Chris Grovenor, Dr Jason Smith, Dr Jan Czernuszka and Dr Simon Benjamin (examiners from the Department of Materials Science); Dr Owen Darbishire, Prof. Roy Westbrook (examiners from the Said Business School); and Prof. John Quah, Dr Alan Beggs, (examiners from the Department of Economics). The external examiners are Prof. Grace Burke, University of Manchester; Prof. Peter Haynes, Imperial College, London; Dr Helen Simpson (Economics, University of Bristol) and Prof. Steve Wood (Management, Surrey 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 Senior Tutor of your college, who will, if he or she deems the matter of importance, contact the Proctors. The Proctors in turn communicate with the Chairman of Examiners.

* for the 2013-14 examinations the Nominating Committee comprised Prof Grovenor & Dr Taylor.

If there are believed to be mitigating circumstances, such as illness, which may have affected the candidate's progress with coursework or performance in a written exam these should be drawn to the attention of the Senior Tutor at the candidate's college as soon as practicable. The Senior Tutor will, if appropriate, inform the Proctors who in turn may communicate with the Chairman of Examiners about the mitigating circumstances. Subject to guidance from the Proctors, if appropriate the Board of Examiners will take into account these mitigating circumstances.

During the marking process the scripts of all *written* papers remain anonymous to the markers.
[In some of the descriptions of marking for individual elements of *coursework* that are given later in this document 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.]

Procedures covering late submission of or failure to submit/deliver one or more elements of coursework to the Examiners

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); 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 Report). Rules governing late submission of these four elements of coursework and any consequent penalties are set out in the 'Late submission of work' clause of the 'Regulations for the Conduct of University Examinations' section of the Examination Regulations (Part 16, 'Marking & Assessment' in the 2013 Regulations).

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

(k) With permission from the Proctors under clauses (3) or (4) of para 16.8, 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%.

(l) 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.

(m) Where, without the permission of the Proctors under clauses (3) or (4) of para 16.8, 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 & Management, normally the candidate will have failed Part I or II as appropriate of the Examination as a whole.

(n) 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 & 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 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 & Management are set out in the MS/MEM FHS Handbook (sections 7 and 10.8 of the 2013/14 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.

2. PARTS I & II

Candidates taking Ec1: Introductory Economics in the 2nd year.
MEM candidates sit the compulsory Ec1: Introductory Economics paper in Trinity Term of their second year. This paper will be set and examined as for all other Part I and Part II Economics papers (see below) 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.

Candidates for Part I (3rd year)
Part I candidates take four compulsory Materials papers (General Papers 1 – 4); one compulsory Economics paper; and one compulsory Management paper. In addition, candidates are assessed on their Materials coursework (practical work, the team design project, and industrial visits). Marks from the Ec1 paper sat in Trinity Term of the 2nd year are included in the Part I total.

Candidates for Part II (4th year)
Part II candidates take one compulsory Materials Options paper and one paper from a range of Management and Economics options. In addition they are assessed on their report of a six-month industrial placement, which carries the weight of two papers.

(1) Setting of papers

Part I Materials 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 Option paper in Part II is set by lecturers of the option courses and two examiners, the examiners acting as checkers. For the Materials papers, the examiners, in consultation with lecturers, produce model answers for every question set. 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 Economics and Management papers are set by examiners nominated respectively by the Economics Faculty and the Saïd Business School.

(2) *Paper format*

Materials Papers
All Materials general papers comprise eight questions from which candidates attempt five and are taken in Part I. Each question is worth 20 marks. The total 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 total 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. Marking criteria are given in section 3.

Economics and Management papers
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.

(3) *Marking of papers*

Materials Papers
All scripts are double marked, blind, by the setter and the checker. After individual marking the two examiners meet to agree marks question by question. If the differences in marks are 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 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 an examiner acting as a checker.

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

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 first five questions in numerical order by question number. 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(2) above will be awarded and (iii) the mark for the paper will still be calculated out of 100.

As the total number of students sitting some papers 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. For the Materials 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 (i) 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
The rubrics on Management and Economics papers differ slightly from the above, but numerical marking is used and all examiners mark to the standard class boundaries [see section on classification] and range of marks (0-100). All scripts in Economics and Management are double-marked, blind. The two assessors who marked the script then meet in order to reach an agreed mark. Should they fail to agree, then the appropriate set of Economics and Management Examiners will determine the final mark.

In cases of short weight, the maximum achievable mark is lowered by the proportion of the paper missing. (For example, in a paper requiring four answers where a candidate has attempted only three, the maximum achievable mark is 75.) In cases where an answer has been partially completed, the marks will use their discretion to decide what proportion of the answer is missing. Marks reflecting such a penalty are flagged "SW" with the proportion of the paper completed (e.g. "SW 75%). In the case of overweight papers it is left to the discretion of the two markers to decide which of the material to disregard. In cases where the rubric requires candidates to show a specified breadth of knowledge, and where it is unambiguously clear that such a requirement has not been met, the mark for the script will be lowered by

at least 5 points. Marks reflecting such a penalty are flagged by "RR" with the number of marks deducted.

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. 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. 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. Such adjustment is referred to as 'scaling' and 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

(4) Marking of Practicals for Part I

Practicals are assessed continually by senior demonstrators in the teaching laboratory and in total are allocated 50 marks. Part I examiners have the authority to set a practical examination. 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 section 1 of the present Conventions.

(5) Marking 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 total of 20 marks. Guidance on the requirements for the reports is provided at the annual 'Introduction to Industrial Visits' talk. Formative feedback is provided in the first of the four reports.

(6) *Marking the Team Design Projects*

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 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.

(7) *Marking the 4th Year Management Project*

The management project is allocated 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. CLASSIFICATION & MARKING CRITERIA

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

Class I Honours 70 – 100	The candidate shows excellent problem-solving skills and excellent knowledge of the material over a wide range of topics, and is able to use that knowledge innovatively and/or in unfamiliar contexts.
Class IIi Honours 60 – 69	The candidate shows good or very good problem-solving skills, and good or very good knowledge of much of the material over a wide range of topics.
Class IIii Honours 50 – 59	The candidate shows basic problem-solving skills and adequate knowledge of most of the material.
Class III Honours 40 - 49	The candidate shows reasonable understanding of at least part of the basic material and some problem solving skills. Although there may be a few good answers, the majority of answers will contain errors in calculations and/or show incomplete understanding of the topics.
Pass 30 - 39	The candidate shows some limited grasp of basic material over a restricted range of topics, but with large gaps in understanding. There need not be any good quality answers, but there will be indications of some competence.
Fail 0 - 29	The candidate shows inadequate grasp of the basic material. The work is likely to show major misunderstanding and confusion, and/or inaccurate calculations; the answers to most of the questions attempted are likely to be fragmentary only.

In borderline cases the examiners use their discretion and consider the overall quality of the work the candidate has presented for examination. The external examiner often plays a key role in such cases.

Part I:

Unclassified Honours – 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. 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. The examiners do not divide the categories further but tutors and students may infer how well they have done from their marks. 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.

Annex: Summary of marks awarded for different components of the MEM Final Examination in 2014 (For Part I and Part II students who embarked on the FHS respectively in 2012/13 and 2011/12)

	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 & Industrial visits	70
	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*

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16 July 2014

Dear Vice-Chancellor (c/o Mrs. Sally Powell),

External Examiner's Report: Honour School of Materials Science and Honour School of Materials, Economics, and Management, Academic Year 2013/14

As a member of the external examining committee for the Department of Materials, it is my pleasure to report that the standards of assessment and student performance in these Honour Schools are excellent. I have reviewed numerous documents, papers, reports and other coursework and can unequivocally state that all procedures and processes reflect the highest standards of performance. Some minor comments are discussed below under the specific topics:

(i) Whether the academic standards set for its awards, or part thereof, are appropriate;

I have concluded that the academic standards of the Department of Materials are indeed rigorous and appropriate based on my assessments of the coursework, examinations and the Part II theses. Careful review of the examination papers and results confirmed that the breadth and depth of the questions successfully facilitated clear differentiation amongst the student performance: First Class student performance was characterised by outstanding knowledge and understanding as evidenced by examination results and the Part II thesis research. In particular, it was a pleasure to review the Part II theses of the First Class students as they demonstrated impressive research skills and excellent interpretation of results, which exceeded my expectations. The students within the Second Class range also demonstrated very high degrees of knowledge and understanding of the subject matter.

(ii) The extent to which its assessment processes are rigorous, ensure equity of treatment for students and have been fairly conducted within institutional regulations and guidance;

I am satisfied that the assessment processes are rigorous and fully reflect the high standards that are expected at the University. I am particularly pleased that all written examinations have been marked "blindly" by two examiners with no knowledge of the student's identity. In reviewing numerous examination papers for all four General Papers and selected Optiional Papers, I noted that the examiners marked the answers fairly and thoughtfully. Furthermore, appropriate attention and consideration has been taken with respect to any additional considerations such as health and disabilities. I also noted that the marking process for the Part II research projects were very thorough, with two Internal Examiners. In response to our 2013 discussion and report, the Department has modified the role of the External Examiner for the Part II vivas, which I believe has succeeded in maintaining the independent assessment of the External Examiner and eliminating the requirement of formally marking the Part II theses. As an External Examiner, I was permitted to question each student, and provide an independent review of the thesis to the Internal Examiners. The rigorous assessment processes were suitable to differentiate student performance (First Class, Upper and Lower Second Class Honours).

(iii) The standards of student performance in the programmes or parts of programmes which they have been appointed to examine (those examining in joint schools are particularly asked to comment on their subject in relation to the whole award):

The student performance standard in these Honours Schools continues to be very high, and is a credit to the University. The range of technical achievement evidenced through the Part II vivas I evaluated ranged from good to outstanding. As to be expected, the calibre of the research varied somewhat, but all individual student performances during the viva varied from good to superb, which reflects the very high calibre of the students. There is no doubt that the students with First Class Honours will be a credit to the Department and the University throughout their future careers.

(iv) Where appropriate, the comparability of the standards and student achievements with those in some other higher education institutions:

It is clear that the rigorous admissions process at the University ensures that the students are the very best, so it is not surprising that the student achievement and standards are higher than most Universities. In addition, the Department of Materials is one of the premier Materials Science Departments internationally. Although there are notable differences in the technical content amongst Materials Science Departments throughout the UK (and internationally), it is abundantly clear that that the breadth of course content, educational standards and student achievement are extremely rigorous, and reflect the University's exceptionally high standards.

(v) Issues which should be brought to the attention of supervising committees in the faculty/department, division or wider University:

I was very impressed with the breadth and depth of the examinations and coursework that I had the opportunity to review. All coursework and project reports reflected very high standards. The Part II theses were impressive and well-written. In particular, the Team Design Project Reports were outstanding, and reflected the high standards of education and breadth of knowledge that are a credit to the Department and University.

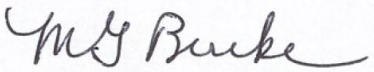
I was extremely pleased with the incorporation of the Advanced Characterisation Module and Modelling Module for the students. The Advanced Characterisation Module is very important for the students who will pursue materials research careers. It may be useful for future Characterisation Module assessments to clarify the marking criteria in terms of technical content, validity of analyses, interpretation of results, and format (organisation of report). I commend the Department for including these very pertinent and important components in the programme.

(vi) Good practice that should be noted and disseminated more widely as appropriate:

I was very pleased with with the Part II assessment process, with two Internal Examiners and one External Examiner for the detailed evaluation and the open viva with the entire committee. The modification of the External Examiner role by eliminating the requirement for the External Examiner to mark each Part II thesis is an improvement, as the External Examiners' perspectives reflect their own Universities (and policies). This modification enabled the External Examiners to concentrate on the thesis, with the opportunity for further clarification and assessment of the student's depth of knowledge. I found this process to be extremely fair and most commendable, for it enabled questioning from all committee members.

I also commend the Department of Materials for the excellent laboratory practicals, which provide the students with extremely valuable opportunities for physical application of information from lectures, and for the incorporation of Modules (Advanced Characterisation and Modelling) for enhancing student knowledge.

I congratulate the Department of Materials on their extremely successful programme, rigorous internal assessments, and very high standards of student achievement.



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Professor of Theory and Simulation of Materials

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9 July 2014

Dear Vice-Chancellor,

External Examiner's Report 2013–14:
Materials Science and Materials, Economics & Management

Having acted as external examiner for the above Honours Schools this academic year I report that I have found all aspects of the examination process to be excellent: assessment procedures are rigorous yet fair, standards are very high, and I observed examples of outstanding student achievement. Together the programmes and the students are a credit to the University.

I have made some minor comments under the suggested headings below, which I invite the Department to consider. In my view the Department should be encouraged to expand its undergraduate student numbers to the extent that it deems possible without compromising the quality of the student experience. There is a growing recognition in the UK of the importance of materials science in tackling the major challenges facing modern society. This will result in growth in both the demand for materials graduates and in the number of highly qualified applicants wishing to study materials. I hope that more students will be able to benefit from the excellent education and training offered by the Department in the future. Therefore some of my suggestions have in mind the practicality of applying the current procedures to a larger cohort of students.

(i) whether the academic standards set for its awards, or part thereof, are appropriate;

The academic standards for coursework, written examinations and research projects are all appropriately high and allow effective discrimination and classification of the students. The proportion of students in each class is also appropriate, and I felt that the classification accurately reflected appropriate levels of mastery of course material and competency in project work.

(ii) the extent to which its assessment processes are rigorous, ensure equity of treatment for students and have been fairly conducted within institutional regulations and guidance;

The four Part I General Papers require a comprehensive understanding of materials science. I was particularly impressed by the overall quality of the examination questions, which were remarkably free of errors and which require students to demonstrate good problem-solving abilities as well as recall of knowledge. Many questions also require a mathematical treatment of the problem, which is a skill that employers are likely to value highly.

The two Part I Option Papers offer students an appropriate degree of choice. The average marks were lower than the General Papers, but I could detect no significant variation in the

difficulty of the questions between topics that might be considered unfair. It is clear that the students found most of the questions very challenging, but this is entirely appropriate given that they have chosen to specialise in these areas. The Option Papers questions are quite long, each worth 25 marks compared to 20 marks in the General Papers. It is unlikely that this confuses students but the Department might wish to consider standardising at 20 marks for all questions and slightly shortening the questions on the Options Paper.

All written examination questions were double marked blind. I consider this to be best practice, although it is not foolproof and is certainly labour intensive. There was some variability in the level of detail provided in the model answers: many were exemplary but in a few cases I felt there was insufficient detail to enable the checker to understand the setter's intentions. The lack of commentary on scripts required to maintain blind marking combined with the large workload on the internal examiners means that they cannot be expected to remember the reasons for the individual marks awarded when the agreed marks are decided, for example if one marker detected an error that was missed by the other. I did not find any significant flaws in the marking of scripts but I am not convinced that a process of first and second marking (not blind but where candidate anonymity is preserved) would have returned significantly less reliable results.

The Part II research projects are a distinctive feature of the programmes that require students to develop independent research skills. Each dissertation is double marked blind and the original independent marks were observed to differ by up to about 15%. The Part II therefore contributes the greatest uncertainty to the final overall mark and it is right that all examiners spend considerable time and effort agreeing the final mark. This rigorous process involves a *viva voce* examination followed by detailed discussion, including the supervisor's assessment of the student's performance. Having participated in half of these examinations myself I am convinced that there is no significant error in the final marks and that the ranking is robust.

Materials science is a broad multidisciplinary subject, and the range of Part II project topics reflects this. This presents a challenge for the small group of internal examiners whose role is to examine the dissertations. There was some variability in the level of detail in the internal examiners' reports, but I also felt that the number of subheadings on which comments were sought made this task overly burdensome. I invite the Department to consider revising the template report to combine the current subheadings under a smaller number of headings and then to encourage its wider use. More radical changes could involve introducing a separate, larger group of examiners for Part II to increase the spread of expertise, or to ask supervisors to nominate an independent expert assessor to write a report on each project. Either way, the main challenge is to ensure effective moderation in Part II, which must inevitably involve a small number of examiners each reading a significant fraction of the reports. The current process achieves this but does not scale up easily to larger student numbers because it relies on the same small group of internal examiners who must also mark the Part I papers.

The procedures for dealing with disabilities such as dyslexia appear to be clear, fair and consistent with the published guidance.

(iii) the standards of student performance in the programmes or parts of programmes which they have been appointed to examine (those examining in joint schools are particularly asked to comment on their subject in relation to the whole award);

I was very impressed by the Part II project dissertations that I read and the associated *viva voce* examinations in which I participated. The interaction with the students was a particularly rewarding and enjoyable aspect of my role as external examiner. Many of the students who obtained First Class marks for Part II performed at the level of doctoral students undertaking their first year transfer exam. Several supervisors mentioned their intention to publish the results of these projects, which makes the high standard of achievement by the top students clear.

(iv) where appropriate, the comparability of the standards and student achievements with those in some other higher education institutions;

In my view the standards and student achievements that I observed were all very high and compare favourably with other UK universities. There are a number of distinctive features of

the programme, including the comprehensive Part I General Papers and the Part II research project, that ensure that students receive and education that is both broad and deep. The outstanding achievements of the top students, particularly in Part II, underline the Department's international reputation for excellence.

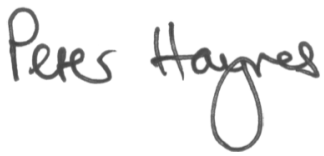
(v) issues which should be brought to the attention of supervising committees in the faculty/department, division or wider University:

I have already noted the challenge of selecting a small group of internal examiners with combined expertise spanning the whole range of Part II research projects. When I first received the list of projects I was surprised by the absence of some senior professors in the Department from the list of supervisors. However I understand that students are offered a wealth of choice from around 70 proposed titles, suggesting a very healthy situation in which students are in high demand.

(vi) good practice that should be noted and disseminated more widely as appropriate.

In addition to the examples of good practice already identified, I was particularly impressed by the hands-on courses on materials modelling and characterisation. This is the appropriate way to deliver training on these topics, which underpin the whole of materials science. Currently students choose to take one or the other, but in view of their evident value I would recommend that the Department makes both of them compulsory. It would be good to encourage other departments to use this approach where appropriate and if they do not do so already.

In summary, the Department of Materials is to be congratulated on the high standards of its assessments and the evident qualities of its students. In particular I am grateful to Philippa Moss and Professor Richard Todd for their efficient administration and oversight of the entire process that meant I was able to use my time as productively as possible.



Faculty of Materials
Department of Materials Academic Committee

RESPONSE TO EXAMINERS' REPORTS 2014

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 and internal reports on all of the individual Materials papers 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 2014 Examinations.

2. Points for inclusion in Responses to the External Examiners

MS & MEM Parts I & II: Professor MG Burke

We thank Professor Burke for her 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 Burke suggested that the marking criteria for the Characterisation Module be elaborated in terms of technical content, validity of analyses, interpretation of results and format (organisation of the report). The 2014 Criteria were as follows:

> The (Characterisation Module) report will comprise:
> • [8] An introduction encompassing a brief description of the sample, and the rationale for using the characterisation techniques that were chosen.
> • [4] A methods section where the experimental techniques and sample preparation are described.
> • [13] A results section where the experimental data are presented.
> • [13] A discussion section where the results are interpreted.
> • [7] A future work section, which could include elements of the project that were not fully completed and a description of the possible benefits of using other characterisation techniques that were not used or not available.
> • [5] A brief summary and conclusion.

The Department's Teaching Committee (DMAC) has reviewed this suggestion and considers that the criteria for this module, and for the related 'Introduction to Modelling' module are appropriate for their purpose and should not undergo significant change; however it believes there is scope to explore with the Lead Senior Demonstrator of the Characterisation module the incorporation of at least some of Prof Burke's suggestions as further guidance within the existing structure and mark allocations. We will make best efforts to incorporate this for the HT 15 delivery of this module.

MS & MEM Parts I & II: Professor P.D. Haynes

We thank Professor Haynes for his 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.

We have followed up his question of whether 'double blind marking' is the most effective and efficient way to ensure allocation of the correct marks for questions on written papers and, taking into account (i) his own comment that it is 'best practice', (ii) a strong endorsement of our current practice by our other external examiner, and (iii) the guidance of the University's Education Committee: the Department's Teaching Committee (DMAC) has endorsed the conclusion of a working group comprising the incoming and outgoing Chairs of FHS Examiners and the Chair of DMAC, that at least for the medium term we should continue with the current method of 'double blind marking'.

On his related point that the lack of commentary on scripts makes it more difficult to reconcile marks (that differ by more than 10% points):

Although the 'blind double marking' process prevents the script itself being annotated, DMAC observed that (i) the individual question mark-sheets include a specific box for comments to be added in the event of the two independent marks having to be reconciled, completion of which normally is required, (ii) that the mark-sheet records a separate mark for each section and subsection of a question, thus automatically capturing where the strengths and weaknesses of an answer lie, and (iii) examiners do at times make brief comments on this mark-sheet when initially marking the scripts, although this third point is not a requirement. DMAC agreed that it would be helpful for the Chair of Examiners to actively brief examiners and assessors on the benefits of recording brief comments in appropriate cases (for example as an aide-memoire should reconciliation turn out to be required, and to assist when they compile their question-by-question report on the paper). The structure of the individual question mark-sheet will be modified to facilitate (iii) in those cases where the marker thinks it would be helpful.

Professor Haynes also suggests we consider revising the template of Pt II marking guidelines thus encouraging its wider use (at present the Part II thesis examiners are required to address in their reports the various elements identified in the guidelines but are not required to use the template itself). DMAC notes the combination of the marking guidelines template and the associated, but separate, detailed descriptors for each decade of marks has served us well for several years: the Committee can see only disadvantage to our efforts to provide a 'level playing field' for marking the Part II theses if the number of sub-headings [(a), (b), etc] in the template is substantially reduced but endorses the outcome of a consultation between the incoming and outgoing Chairs of FHS Examiners and the Chair of DMAC: namely that there is scope for providing more guidance on how the template may be used and at the same time making the *explicit* use of its **major** headings (1 to 12 at present) *compulsory* in the report submitted by each Part II thesis examiner.

The rubric for the template will be expanded to clarify that:

(i) comments under a major heading can be made in one combined paragraph if so wished (for example a combined short paragraph to cover 9a & 9b); the choice to use the sub-headings being solely a matter of personal preference for each examiner.

(ii) if the examiner feels it would be helpful, more than one major heading may be addressed in a single paragraph as long as the major headings are identified at the start of that paragraph.

Also for 2015/16 onwards, consideration will be given to the possibility of (i) merging a small number of the major headings and (ii) rephrasing some of the major headings; for example '10. Does the thesis show original thinking on the part of the student?' might

become ’10. What *evidence*, if any, does the thesis provide of original thinking on the part of the student?’

Professor Haynes also suggests we might wish to consider reducing the marks [and hence time] per question for the Options Paper Questions [in effect this would be from 25 marks to 20 marks and from 45 minutes to 36 minutes (includes reading time)] to match the General Paper Questions. After consideration, DMAC prefers not to change our present system which for all six written papers is based on similar contact hours of teaching per paper and an associated parity of equal exam time and equal credit per paper. DMAC also takes the view that it is entirely appropriate to set slightly longer questions on the Options courses.

Finally Professor Haynes suggests we consider making both Modelling & Characterisation Modules compulsory rather than offering a choice of one from the two modules. We are pleased to confirm that the decision to do this had already been taken in principle and detailed planning is in progress with a view to implementing this change once the timetable is freed-up as the MEM programme phases out.

MEM Parts I & II, Management Papers: Professor S.M. Wood

We thank Professor Wood for his positive report and for his careful scrutiny of scripts over the last three years and we concur with his comment on the importance of being willing to award marks in the high 70s or greater when an extremely high quality essay is assessed.

Regarding his suggestion on the ’hanging 9’: For the MEM programme we do not operate a preponderance rule and therefore this problem does not arise. We would not be comfortable with adjusting marks for individual papers of, for example, 69% up or down to 70% or 68%. Rather our Board of Examiners gives careful consideration to the final degree class of any candidate who scores an overall degree mark of, for example, 59.1%, 69.3%, etc, looking at their full profile of marks, and without adjusting the actual overall mark is able to recommend the award respectively of an ‘Upper Second’ or ‘First’ if that is felt to be appropriate. [Normally a mark in the range 69.5 to 69.99’ is automatically rounded up.]

MEM Parts I & II, Economics Papers: Dr H Simpson

We thank Dr Simpson for her positive report and for her careful scrutiny of scripts, and we support her suggestion that the Faculty of Economics assess the extent to which appropriate use is made of the upper range of available marks.

3. Further Points

(a) Noting the importance of considering averages over five or six years when dealing with small cohorts of students we observe that the proportions of first class and upper second class degrees awarded do not differ greatly from the MPLSD averages. Disappointingly, in recent years the five-year averages for FHS Materials outcomes have shown a gender gap opening up, with a higher proportion of male students gaining a first. The gap is similar to that seen for several years when results are averaged over all MPLS subjects. In Materials the gap seems to be driven by differential performance on the written papers and we are looking into this in more detail.

(b) The Examiners suggested that in future the objectives and marking criteria for the Characterisation & Modelling Modules be made available to the examiners and students. At present these **are** provided through WebLearn by means of the slides from the introductory talks given by the Module Organisers (and are referenced at this location in the Examination Conventions); in future we will in addition extract this information and provide it more directly on the website and/or in the FHS Handbook.

(c) We note the improved paper average for Paper GP3 this year, a paper on which performance has often been weaker than others. However we note that the result this year may be anomalous so we will continue with the initiatives on the teaching of this paper that we are piloting this year.

(d) The trial this year of a different approach by the External Examiners to the scrutiny of the Part II theses is reported on positively by all examiners and will be embedded.

4. Examination Conventions

We confirm that when updating our Examination Conventions we consider the points in the EdC notes of guidance on Examinations & Assessment, as summarised in the Guidance on Examination Conventions issued by the MPLS Division.

A.O. Taylor, Chairman of DMAC, 12/11/14

E(M)EM Standing Committee

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

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The Vice-Chancellor
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Education Policy Support
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14th July 2014

EXTERNAL EXAMINER REPORT (ECONOMICS) FOR THE DEGREES IN: ECONOMICS AND MANAGEMENT (11TH JULY); ENGINEERING, ECONOMICS AND MANAGEMENT (4TH JULY); AND MATERIALS, ECONOMICS AND MANAGEMENT (4TH JULY)

OVERALL COMMENTS
This was my second year as an External Examiner for Economics on the above degree programmes. As last year, the examinations process was extremely well administered and managed, and I would like to highlight the excellent management of the process for Economics by Dr Christopher Bowdler, Dr Alan Beggs and Katherine Cumming. In addition, all three exam board meetings were again run very efficiently and professionally.

I) ACADEMIC STANDARDS
For all three degrees the academic standards set were entirely appropriately, as were the degree classification thresholds.

II) ASSESSMENT PROCESSES
The assessment processes were rigorous and fair. As last year, the examination papers for Economics were very well put together, giving students ample opportunity to demonstrate their understanding, and also challenging and stretching the very best candidates, and therefore allowing the examinations process to clearly distinguish between performances at different points in the distribution.

The process of double-blind marking, followed by marks being agreed by the two markers ensures that exam performance is fairly assessed.

III) STUDENT PERFORMANCE
As last year, the achievement of students on these degree programmes is very high, demonstrating the students' ability, the depth of their understanding and also the strength of teaching. Some of the answers that I reviewed, even for the borderline 1st / 2:1 students, were extremely impressive.

For the degrees of Engineering, Economics and Management (EEM) and Materials, Economics and Management (MEM), taking into account the fact that more technical papers can produce quite

different distributions of marks compared to discursive or essay-based exam papers, there was no evidence that students were either systematically under or over-performing on the Economics component of the course compared to the other disciplines. However, given the very small numbers of students taking individual Economics papers on these degree programmes it is a little difficult to make generalisations.

IV) COMPARABILITY WITH OTHER HIGHER EDUCATION INSTITUTIONS

As last year, the standards set in the Economics exam papers are comparable to, or above, the standards set at my university (Bristol). The technical papers in quantitative economics, econometrics, economic theory and game theory set a high standard and were comparable to those set at Bristol where the undergraduate Economics and Economics and Econometrics degrees contain a strong mathematical and econometrics component. Candidates sitting the essay-based options papers tend to be given a much larger choice of questions (for example, in Labour Economics or Industrial Economics papers) compared to the equivalent papers at Bristol, which I expect reflects differences in tutorial teaching methods, but the standard of questions asked is similar.

As last year, I would also like to note that the range of option choices available to students was extremely impressive.

V) OTHER ISSUES

Last year I raised the issue of providing more solutions for exam papers. This year there were substantial improvements to this, with many (but not all) question setters providing sketch answers or guidance to markers for essay-based questions. This is helpful in ensuring better consistency in marking, and can also help the question setter come up with better questions and ensure that the different questions within a paper are similarly challenging. As last year, in general, excellent solutions were provided for the technical Economics papers.

Given the extremely high standards of performance I noted above, I think it would be worth assessing whether the very, very best answers are in fact receiving high enough grades, in particular on essay-based questions. For essay papers there is a slight impression that the marks are being compressed towards the 60s range of the scale. The Economics department uses step-marking to try and ensure that a full range of marks are used. At some point I think it might be worth some internal evaluation of whether the step-marking is meeting its aims, and whether the steps are set at the optimal intervals. In particular the steps in the 70s range seemed to be further apart than in the 60s range, and a potential concern is that this is in fact discouraging markers from using marks in the high 70s and above.

VI) GOOD PRACTICE FOR FURTHER DISSEMINATION

As above, the provision of sketch answers to essay-based questions is very useful for markers. These answers are also very helpful for External Examiners when evaluating exam papers prior to the exams, and when reviewing scripts.

The provision of information and guidance for the External Examiners when assessing scripts prior to the Exam Board meetings was extremely good, in particular in terms of highlighting borderline candidates and specific scripts to review.

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14th July 2014

Catherine Whalley
Head of Education Planning & Quality Review
Education Policy Support
University of Oxford
University Offices
Wellington Square
Oxford OX1 2JD

Dear Ms. Whalley,

External Examiner's Report: Management

This is my final year acting as external examiner for Management programmes within Management and Economics, but also across the Engineering and Materials programmes. Consistent with previous years, this year I attended three examination boards and was provided with access to examination scripts and marks across the spectrum of student performance:

1. Materials, Economics and Management Exam Board (Friday 4th July 2014)
2. Engineering, Economics and Management Exam Board (Friday 4th July 2014)
3. Economics and Management Exam Board (Friday 11th July 2014)

I structure my report in accordance with your suggested headings after making some general observations:

First, I would like to thank the team for moving to a system of producing short, indicative answers to exam questions. This is hugely helpful to external assessors, but should also aid colleagues when working through the setting of assessment. It is standard practice across all institutions that I have had experience of and most exam papers that I saw this year were accompanied with such a rubric. The final year assessment that I saw was appropriately targeted and stretching for students.

Second, the standard of the students' work continues to be extremely high. It demonstrates a high level of academic engagement and wider reading that is infrequently seen in other institutions at such a consistently high level. The teaching team and students deserve congratulations.

Third, the marking process is robust. The anonymous and "double blind" procedure works well. Where initial marks were some way apart, markers discussed an "agreed mark". Such practice ensured that assessment was considered. Given the high calibre of the students, it was not surprising that there was a preponderance of First and Upper Second Class marks. Indeed, this year there were a record number of First Class awards in Management & Economics. However, I firmly believe that rather than this high level of Firsts being evidence of softer standards of assessment, it is instead evident of students achieving the marks that they deserve. In the examination boards I attended, individual students were given close consideration by University staff and external examiners, especially in circumstances where they sat on grade borderlines.

While I will no longer be external examiner for management next year, I have a couple of suggestions for consideration by the team for the coming academic year. These were discussed at the examination board:

- **Great exam essays deserve great marks** – With essay-based examination papers such as Strategic Management, there seemed a reluctance by markers to award marks above circa. 72%, even when the work was clearly exceptional. In such instances, markers at other universities would give marks well into the 80s, using a fuller range of marks. Indeed, it seems (albeit anecdotally) that quantitative subjects allow students to access these higher marks as answers are either right or wrong. In contrast, assessment in essays is more subjective and therefore Firsts, when awarded at Oxford, tend to be limited to the early 70s.

  I understand the concern that this would lead to "everyone getting Firsts". I do not believe that this is the case. All I am suggesting is that the excellent First class essay answers should be rewarded with strong First class marks, rather than low Firsts. I am not suggesting that there should be more of them.

- **"Hanging 9" issue** – I understand that one of the criteria for awarding a certain class of degree, along with the overall average, is the number of marks in that class. Consequently, whether a student receives 59 or 60 – or alternatively, 69 or 70, may well be critical. At all other universities with which I am acquainted, policies have been introduced to effectively encourage colleagues to avoid such "hanging 9s". In other words, for marks to be clearly within a grade boundary. I recall a handful of students in this year's Board who achieved two or three 69% marks. I understand that we mark in percentages but the team may wish to consider awarding a 70 or 68 in such cases.

I now address the suggested headings:

(i) Whether the academic standards set for its awards, or part thereof, are appropriate.

The assessment was challenging and provided the basis for students to demonstrate performance across the entire marking range. The assessment offered an appropriate balance between academic theory, critical analysis and the application to management practice.

(ii) The extent to which its assessment processes are rigorous, ensure equity of treatment for students and have been fairly conducted within institutional regulations and guidance.

The anonymous and "double blind" procedure works well. Markers discussed an "agreed mark" where their initial marks were some way apart. Such practice ensured that assessment was considered. Given the high calibre of the students, it was not surprising that there was a preponderance of First and Upper Second Class marks.

In the examination boards, individual students were given close consideration by university staff and external examiners, especially in circumstances where they sat on grade borderlines. External examiners were provided with all of the resources necessary to understand student performance and assessment.

(iii) The standards of student performance in the programmes or parts of programmes which they have been appointed to examine (those examining in joint schools are particularly asked to comment on their subject in relation to the whole award).

Student performance was typically categorised as either First Class or Upper Second Class. There were very few Lower Second Class results. This reflected the ability and genuine attainment of the cohorts that I looked at.

(iv) Where appropriate, the comparability of the standards and student achievements with those in some other higher education institutions.

The very top end of student performance was of truly exceptional ability and beyond that I have typically observed at other universities. These achievements were all the more notable given the intensive exam-based Finals nature of assessment.

(v) Issues which should be brought to the attention of supervising committees in the faculty/department, division or wider University.

Consistent with last year, Faculty should be congratulated on contributing to some fine student performance in the final examinations. The process for the setting of examinations and the subsequent assessment is tight, fair and consistent.

I have suggested that the team reflect on two issues earlier in this note – hanging 9 marks and using the full range of marks for essay-based papers.

(vi) Good practice that should be noted and disseminated more widely as appropriate.

See above.

If you have any further queries, please feel free to contact me on sm.wood@surrey.ac.uk. I have very much enjoyed my time as external examiner at Oxford and wish you all the best.

Yours sincerely

Professor Steve Wood

Minutes of the discussion of Examiners' Reports at the EMEM Standing Committee

STANDING COMMITTEE FOR EEM AND RELATED STUDIES

Part II – Reserved Minutes of the meeting held on 30 October 2014

7. Examiners' Reports

7.1. Chairman's Report for EEM Parts A, B & C

The Standing Committee received the Chairman's Report for EEM Parts A, B & C and was pleased to note the high numbers of 1st class degrees. The Standing Committee noted the tapered shift procedure applied to some papers, affecting marks in the middle of the range of marks, and the deliberations relating to borderline cases and the use of hard boundaries. No matters of concern were raised.

7.2. Chairman's Report for Economics & Management

The Standing Committee received the Chairman's Report for Economics & Management and noted the examiners' support for introducing step marking to the Management papers. No issues of concern were raised.

7.3. 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 were raised.

7.4. External Examiners' Reports

The external examiners' reports were received from:

- Engineering: Professors Allen and Powrie
- Economics: Dr Simpson
- Management: Professor Wood
- Materials: Professors Burke and Haynes

The Standing Committee was pleased to note the overall complimentary nature of the comments from the external examiners. The Engineering external examiners' comments relating to borderline cases were being addressed through USC. Prof. Sheard reported that the recommendation to pursue electronic submission and plagiarism detection software was also being taken forward with software from JISC being considered.

The main points made by the Materials external examiners' related to elements that were not taken by MEM students.
Both Economics & Management external examiners noted concern that the full range of marks did not seem to be used and the Standing Committee was pleased to hear that the step marking in Management was actively being considered.

3 of the 6 external examiners had completed their term in office and the Chair recorded his thanks for their contributions, to be included in his letter of response.

Response of EEM and Related Studies Standing Committee to Examiners and Departmental Teaching Committee reports, FHS 2014

The Standing Committee for Engineering Economics and Management (EEM) and Related Studies has viewed and discussed the reports for EEM Parts A, B and C and for MEM Parts I and II, produced by the boards of examiners, external examiners and the relevant teaching committees in participating departments. The Teaching Committee reports are appended below. The Committee

i. was pleased to note the generally positive comments from External Examiners regarding the high standards of the courses and the rigour and robustness of the examination procedures.
ii. noted the high number of first class degrees awarded for EEM this year as a reflection of a particularly strong cohort.
iii. was pleased to hear of the introduction of step marking in Management papers, as a means to address comments from External Examiners regarding use of the full range of marks.
iv. supports the response by DMAC (Materials) and SBS (Management) to Professor Wood that the issue of 'hanging 9' marks requires no specific action at present.

The Committee would like to record its thanks to the External Examiners Professors Allen and Powrie (Engineering), Dr Simpson (Economics), Professor Wood (Management) and Professors Burke and Haynes (Materials) for their hard work and support of the degree courses, in particular Professors Wood and Murray who have come to the end of their period of office and Professor Haynes who has stood in as an External Examiner for this year only.

Prof Jason Smith
Chair of E(M)EM SC

Response of the Department of Economics to Exam Reports 2014
Engineering, Economics and Management: Internal and Externals.
The Department notes with pleasure the large fraction of students obtaining Firsts in this degree this year (72%, compared to 41% over the previous five years) and notes that this may be a selection effect. It has no comments on the External Examiners' reports (the External Examiner for Economics and Management had a report that covers the E(M)EM degrees as well).
Materials, Economics and Management: Internals and Externals.
There were 3 candidates for Part I, taking the Microeconomics paper (having taken Introductory Economics in 2013), and 9 candidates in Part II, of which three took a single economics paper (Game Theory). The Department has no comments.

Response to External Examiner in Management by the Academic Course Director of the Said Business School

Professor Steve Wood,
Surrey Business School Guildford,
Surrey GU2 7XH UK

Dear Prof Wood,

Thank you for your contribution to the maintenance of the high standard of performance of the students on the Economics & Management; Engineering, Economics & Management and Materials, Economics & Management programmes.

Thank you too for your comments on the high standards attained by our students. Your comments will be conveyed to the students and the teaching faculty.

Your suggestion for providing short, indicative answers to exam questions has proved helpful and we are grateful to colleagues for having adopted this suggestion, and we will carry this forwards.

We note your comment that not enough high first class marks are being awarded to the best essays. This comment will be shared with assessors. We are planning to move to step-marking for Management papers, and will review carefully the adoption of this change to see if it does indeed lead to the higher marks that the candidates undoubtedly deserve. This may also help to address the problem of hanging 9s.

Yours sincerely,

Janet Smart
Undergraduate Course Director
Saïd Business School