Curriculum Committee minutes 11 Nov 2014

1 Membership

1. According to Constitution of the the Curriculum Committe, approved by the Faculty Board minute 106 of 15 October 1998,

   Its membership consists of two members of DAMTP, two members of DPMMS, two junior members of the Faculty, and two members who serve *ex officio* to ensure good liaison: the Chairman of the Teaching Committee and the Chairman of the Faculty Board.

2. Dr Cowley, in his capacity as the Chairman of the Faculty Board, convened the meeting of the Curriculum Committee at which point Dr Tehranchi was elected its Chairman.

3. At the suggestion of Dr Cowley, the Committee unanimously agrees that good liaison with the Faculty Board can still be achieved without the requirement that its Chairman serve on this Committee.

4. However, it remains desirable to have six senior members of the Faculty on this Committee. For instance, the ongoing review of the provision of analysis courses would benefit from another member of DPMMS.

5. Therefore, the Committee **recommends** that the Constitution be amended to remove the Chairman of the Faculty Board from the list of members, and to grant the committee the power to co-opt a member of the Faculty to fill the vacancy.

2 Non-top students

1. The Faculty must cater to students with a very wide range of abilities. There is general agreement that the Mathematical Tripos challenges and enriches the very best of our students. However, there is reason to believe that there is room for improvement regarding the education of those further down the class list.

2. Indeed, the report of the Teaching and Learning Review, received by the Faculty on 26 January 2012, says

'Whilst retaining the excellence of the course for the best mathematicians, the Committee recommends that the Faculty gives serious consideration to ensuring that they optimise the chances for all students, including those undergraduates who do not find themselves within the top cohort reading mathematics.'

3. The Faculty has already convened a working party to address the TLR report. The working party has made a number of suggestions, and several of their recommendations have already been put into practice, including

   - the Saturday Café,
   - the abolition of CATAM alphas and betas,
   - the re-introduction of the dependency tables in the Schedules.

4. The Committee discussed several proposals, some rather radical, for further implementing the recommendation of the TLR Report. Such proposals include 'escape routes' for those students who decide after IB that they would not like to continue on to Part II mathematics. The idea might be to partner with other faculties to offer alternatives to Part II including History of Mathematics, Mathematics for Education, Mathematics & Management, Mathematics & Computer Science, Mathematics & Physical Sciences, Mathematics & Biological Sciences. The Committee recognises the challenges of implementing such proposals and therefore does not now recommend the Faculty pursue them in the near term.

5. It seems that one problem with the current written exam system is that it does not provide much reward to conscientious students for demonstrating their knowledge of bookwork. This issue is, of course, related to the short exam questions and, for Part II, the provision of C courses. See the next section for the Committee's remarks concerning C courses.

6. Examiners should be reminded of the relative number of merit marks available from short and long questions: a short question can earn a maximum of 15 merit marks, but a long question can earn a maximum of 35 or 50 merit marks, depending on the number of alphas the candidate has.

7. Among the exam questions written over the past few years, there is the perception that less work is required to obtain 10 out of 20 marks on a long question then 8 out of 10 on a short question. This perception defeats the role of the short question in providing an outlet for the weaker students to demonstrate their knowledge: answering a short question is perceived to be simply too much of a gamble relative to answering a long question.

8. Therefore, the Committee **recommends** that the Faculty re-emphasise to examiners that short questions really are short. For instance, a handwritten solution to a short question should be between 1/3 to 1/2 the length of a solution to a long question.

9. The Committee further **recommends** lowering the threshold for a short beta from 8 to 7 out of 10 marks.

10. There was some support for the proposal that the threshold for long betas be raised from 10 to 12 out of 20 marks, but not enough support to make a formal recommendation at this time.

11. Another issue that arose in this discussion are the three lecture courses that offered during the Easter Term. All three are examined in IB, but the Schedules say

    'One course, Optimisation, can be taken in the Easter term of either the first year or the second year. Two other courses, Metric and Topological Spaces and Variational Principles, can also be taken in either Easter term, but it should be noted that some of the material in Metric and Topological Spaces will prove useful for Complex Analysis, and the material in Variational Principles forms a good background for many of the theoretical physics courses in Part IB.'

12. The Committee is concerned that there is uneven support for students attending these Easter Term courses. In particular, many IA students who attend the courses must wait until the Michaelmas Term of the following year, or later, for supervision. There was some support for requiring these lecturers to provide written lecture notes for summertime revision, but not enough to make a formal recommendation. Indeed, there is concern that mandatory provision of typed notes might send the signal that the Faculty regards lecture attendance as is not important. Fortunately, it seems that there already exists a few good sets of lecture notes already available online. The Committee wishes to emphasise to future lecturers of Easter Term courses the value of these resources to their students.

13. To help clarify the situation, the Committee also wishes to ask the Director of Studies the following questions. (a) To your directees of which year, IA or IB, do you recommend the Easter Term courses? (b) During which term do you arrange supervisions for the Easter Term courses?

14. Answers to the above questions would used to formulate advice to lecturers. In particular, it seems that the lecturing in some of these courses suffers from the lack of clear guidance as to the level of the intended audience.

15. The teaching of Metric & Topological Spaces is tied up with the provision of analysis courses. See Section 4 below for further comments.

16. The Committee is pleased that Variational Principles seems now to be popular and successful. It could be used as a model for the other Easter Term courses.

3 C courses in Part II

1. The Committee notes that there is a general consensus that many of the C courses in Part II are not achieving their intended goals.

2. There seem to be two main goals: (a) to teach interesting yet accessible mathematics, and (b) to provide exam questions which can be done by a conscientious student, but do not significant innovation or insight.

3. There are a few C courses which do seem to be successful, in that they seem to be popular with the students as measured both by their feedback and by their exam question takeup. Examples are Number Theory and Mathematical Biology.

4. However, there are too many C courses which have not been successful in these metrics. A recent example is Geometry and Groups, which is no longer offered.

5. A working party has been formed to study various issues around the C courses, and to propose concrete suggestions for improving the existing regime. The members of this working party are Dr Tehranchi, Mr Large, Dr Martin (DPMMS), Prof Scholl (DPMMS), Dr Evans (DAMTP) and Prof Ogilvie (DAMTP).

6. The working party will report to the Curriculum Committee. The following comments are directed to the working party.

7. There needs to be a clear operational criterion for labelling a given course C or D.

8. For example, Graph Theory is similar to Number Theory in many regards: it does not depend on a great deal of prerequisite knowledge and is popular both in terms of student feedback and exam takeup. However, there does not seem to be much support for the idea of reclassifying Graph Theory as a C course. The labelling criterion proposed by the working party should be able distinguish these courses or, if not, provide a convincing argument for the reclassification of one of these two courses.

9. What is the right balance of numbers between C and D courses? Should some D courses be reclassified? Indeed, are there currently some C courses which are more difficult, as measured by exam performance or some other metric, than some D courses?

10. Is there value in having accessible D courses? Indeed, reclassifying a long D course has the negative consequence of removing two possible alphas from the exam, with disproportionate impact on non-top students. On the other hand, does the existence of some accessible long D courses undermine the educational role of C courses?

11. One such definition of a C course is that it spreads the content of a 16 lecture D course into 24 lectures. In particular, it provides more worked examples in lectures.

12. Using the 16→24 lecture definition above, could a short D course such as Integrable Systems be reworked to include more examples? The working party should consider whether the classification of Part II courses, such as the example of Integrable Systems, should depend on their importance to Part III courses.

13. There should be an appropriate balance between the number of Pure, Applied and Applicable C courses.

14. The working party should be aware that there seems to be a perception among some students, or at least there seems to be a perception among the teaching staff that there is a perception among the students, that the content of C courses is inherently less interesting or important, and therefore, such students might miss out on fundamental material. For instance, there is some anecdotal evidence for this for Classical Dynamics. In particular, there is some reluctance to classify some courses as C because there is a fear among the lecturers that top Part II students will miss out essential background for Part III. What can be done to fight these perceptions?

15. It seems that an important predictor of student interest in Part II courses is the success of the prerequisite courses from Part IA and IB. For instance, the success of Number Theory might be due in part to the popularity of Numbers & Sets in IA.

16. A preliminary proposal for a course on Soft Matter was received from Prof Goldstein. The Committee appreciates the proposal, but feels that it not clear that the intended audience would actually have sufficient background for the proposed course to be successful as a C course. Furthermore, since Geometry & Groups was dropped last year, the working party's priority should be to find suitable replacement among the Pure courses.

17. The Committee understand that a course on Cellular Automata & Computability is being designed by Dr Martin. This seems promising and the working party is encouraged to give this proposal serious consideration.

18. The idea of having a course on Big Data & Machine Learning was floated by Dr Eglen, but there does not seem to be much support from the Statistical Laboratory for such a course at this level, though perhaps it would work at Part III.

4 Analysis

1. There is a longstanding goal to review the analysis courses in the Tripos. For various reasons, including the departure of staff, a comprehensive review has not been completed recently.

2. As mentioned above, the success of later year courses depends on their prerequiste courses from earlier years. Therefore, the Committee will undertake this review with a 'bottom-up' approach, considering first the success of courses in IA and IB.

3. Preliminary comments include adding uniform continuity to the IA Analysis schedules. Another goal is to review the overlap between Metric & Topological Spaces and IB Analysis II. These issues are related to the treatment of Easter Term courses discussed in Section 2 above.

4. There is general agreement that the Part II course Partial Differential Equations is not succeeding. For instance, the exam takeup was only 4.4% in 2014. This is a shame, since the study of PDEs is an important part of classical mathematics that continues to be extremely relevant for contemporary mathematical research, both pure and applied. For two examples of this last point, consider that proving the global existence of smooth solutions of the Navier–Stokes equation is a Clay Institute Millenium Problem, and that defining a new notion of solution of stochastic PDE and its application the KPZ equation was one of the achievements rewarded by the 2014 Fields Medal.

5. One possible explanation for the current state of affairs is that the applied minded students are turned off by the course's emphasis on rigour, and yet the pure minded students perceive that PDEs are not important in pure mathematics.

6. The Committee will prepare a report for the Faculty for its meeting of 22 Janary 2015. In the meantime, the following proposals are being considered:

   - To better integrate PDEs and Linear Analysis, perhaps changing the scope of PDEs to the analysis of certain concrete function spaces, such as Sobolev spaces.
   - To change the style of PDEs to an Applied methods course. This might raise its popularity, but there already are a number of Part II methods courses. Perhaps the distribution of content can be reworked betweeen these courses.
   - The Committee is strongly leaning to the option of simply **dropping PDEs from Part II** and moving it in its current form to Part III.

5 Next meeting

The Committee agreed to meet once more before the beginning of Lent Term. The next meeting is tentatively planned for the first of December. The precise timing will be decided by email.

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