

Report of the Curriculum Committee

12 Nov 2017

1 IB Geometry

The Committee received the following proposal from Prof Smith regarding the IB Geometry schedule:

(1) Replace the first three paragraphs (totalling 6 lectures) of the current syllabus with the wording below, now covering only 5 lectures:

Euclidean and spherical geometry; length, lines and groups of isometries; Mobius maps and stereographic projection. [3 lectures]

Triangulations of the sphere and torus. *Informal discussion of abstract smooth surfaces, orientability and statement of the classification of compact smooth surfaces.* (starred so non-examinable) [2 lectures]

(2) Increase the amount of time for the last two paragraphs on the syllabus from [2 lectures] and [3 lectures] to [3 lectures] and [3 lectures], respectively, *without adding any additional content*. Change the line “Abstract smooth surfaces and isometries” to “Abstract smooth surfaces and isometries, with examples”.

The proposal is widely supported among the geometers in DPMMS and has been vetted by theoretical physicists in DAMTP. The student members commented that for many, the hardest part of the existing Geometry course was understanding Riemannian metrics, and that the course would benefit from more time and examples given on the topic. This matched the experience of several members who are also Directors of Studies. All agreed that this proposal would alleviate these concerns.

The Committee **recommends** that the Faculty Board implements this proposal, subject to approval from the DPMMS Lent Term staff meeting.

2 IB Linear Algebra and Geometry

The Committee received another proposal from Prof Smith

(1) to make Linear Algebra a 16 lecture course

(2) to make Geometry a 24 lecture course.

Regarding proposal (1) the Committee notes that Linear Algebra is listed as a prerequisite (essential, useful or desirable) for four Part II courses. We also highlight the importance of Linear Algebra to applied students. The Committee agrees that it would be inconceivable for the Tripos not to contain a proper course in linear algebra, and that IA Vectors & Matrices is not it. The student members comment that the existing Linear Algebra course feels content-heavy, and that it would be difficult to cover the same material in 16 lectures.

However, regarding proposal (2), the Committee agrees that IB Geometry is often seen by students as very difficult – not only does the course cover a lot of material in 16 lectures, but also there is very little geometric preparation in IA or in the Michaelmas term of IB. The dearth of geometry is unfortunate given the prominence of the subject in modern mathematics, not to mention the presence of a large number of geometers in DPMMS.

The Committee **recommends** a working party should be formed to look into expanding the teaching of geometry within IA and IB, for instance, by injecting a more geometrical standpoint into the schedules of one or more courses.

3 Role of Easter term courses

The Faculty Board has asked to Curriculum Committee to review the overlap between IB Metric & Topological Spaces and IB Analysis II. A working party consisting of Prof Leader, Dr Zsak and Prof Wickramasekera.

Although working party has not yet produced a recommendation, the Committee had a preliminary discussion regarding the role of the Easter term courses including Metric & Topological Spaces. These courses are unlike any others as they are open to both IA and IB students, and lectured only weeks before the exams. No concrete recommendation came of this discussion at this time, but the main points are summarised below. The Committee welcomes comments from the Faculty Board.

The Part IB schedules currently gives the following advice:

“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.”

The student members of the Committee note that the schedules seem to imply that a student taking none of the Easter Term courses in first year will not be disadvantaged in IB. However, their experience was that taking these courses in IA was more useful than they had expected. Variational Principles appears in a number of places – for instance in the Euler–Lagrange equations of IB Geometry; as does Metric & Topological Spaces – metric spaces in Analysis II; and Optimisation – Lagrange multipliers in Statistics. The Committee

discussed the proposal that the statement be strengthened to give the strong expectation that one or more of these courses should be taken during the first year. However, a precise form of words was not agreed.

The Committee considered the question of whether Easter Term was a good time to lecture essential material, and whether this should be included in IA. While there was not unanimous agreement, there was an overall view that the Easter Term courses currently work well, and that they contain a good set of ideas that could be worked on over summer. Ideally, Easter courses should be small enough that a student changing their mind late in the year, while not advisable, can pick up these courses as a last-minute choice. According to a questionnaire circulated among the Directors of Studies, supervision takeup for Variational Principles and Metric & Topological Spaces is quite high. There was a view on the Committee that Optimisation does not link as well into the other IB courses.

We discussed the issue of whether there could be more clarity to students if there were only two Easter Term courses, with IB Optimisation being removed and perhaps its content combined with II Optimisation & Control, and the possible expansion of Markov Chains or Statistics to keep a good representation of the Statistical Laboratory in Part IB. The Faculty could then give more directed advice, expecting most or all first year students to go to both remaining Easter Courses, and reinforce that learning over summer. This would also ‘slim out’ and simplify the IB offerings, as at the moment there are lots of courses. On the other hand, the student members feel that choosing from three Easter Term courses was not seen as difficult, and most undergraduates were happy to attend lectures in first year and work on examples sheets in their second year.

As mentioned in our Easter 2017 report to the Faculty Board, a working party in the Statistical Laboratory is looking at the teaching of optimisation in the Tripos. This working party had submitted a proposal to update IB Optimisation, which will be implemented this coming Easter term. The Curriculum Committee awaits further proposals from this working party, re-iterating the recurring problem of difficulty of finding supervisors.

There was some discussion of swapping the positions of Markov Chains and Optimisation, but it was concluded that it was better to provide continuity from IA Probability, and for Markov Chains to be seen as a ‘main’ course, rather than a marginal Easter Term offering.

The Committee suggested an informal recommendation to the Statistical Laboratory working group to consider dropping IB Optimisation to allow for a stronger Part II course, and then to set the strong expectation to students that the remaining two Easter Term courses are useful. The Committee concluded that this should be raised as a possibility, rather than a clear view or proposal.

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