Mathematics Teachers' Association (India)

A statement on the draft model curriculum
For undergraduate mathematics
Proposed by the UGC in August 2025
September 12, 2025

The University Grants Commission has put out draft curricula for the four year undergraduate programme for several subjects, including mathematics, and sought feedback from the public. This statement is in this regard.

The proposed curriculum is to be seen in the light of the National Educational Policy 2020, which has sought to extend the three-year undergraduate programme to a four-year programme, with the stated objective of making students ready for work and for research. The NEP also speaks of providing holistic education.

1. Curricular purpose and structure

Considering that the UGC's proposals will have an impact on what will be taught in thousands of colleges and universities, and consequently on lakhs of students over the next generation, the document carries a great weight of responsibility. In the context of mathematics, we believe that the UGC proposal should spell out the following:

- A critical assessment of the existing Mathematics curricula in the country, identifying the strengths to be built on, gaps to be addressed, and new priorities, if any, to be specified.
- A clear rationale for any drastic changes being proposed.
- An articulation of what is sought to be achieved in the new proposed curriculum in the light of all these.
- A structure with arguments for what needs to be in the core, what curricular choices are to be offered to students and how.
- A delineation of multiple pathways addressing the diverse needs of our student population.
- Implications for teachers and university systems arising from all these.

Nothing like this has been even attempted in the document. Some courses have been listed as "value added courses" and some as "skill enhancing courses", but without a rationale of what is being attempted through such courses, it is hard to make sense of why any of the courses listed are being proposed.

2. Historical consciousness

An understanding of the history of development of concepts and ideas is desirable for every discipline, perhaps even more so for mathematics which is among the oldest disciplines of

study. There is an additional feature relevant to mathematics: the non-European roots of mathematics have been largely ignored by the education system, and an understanding of the history of mathematics that places mathematical learning and achievements across cultures, placing Indian contributions in context, is a felt need. All this could easily be done in a course taught in a single semester, perhaps with another course offered for the few who wish to explore such histories in depth.

However, the proposed draft goes entirely overboard in this regard. Instead of emphasising the global nature of mathematical development while highlighting the shining contributions India has made to mathematics, a large number of courses have been listed, each with content that would not need more than a couple of classes to transact, bunched together with no apparent reason.

Moreover, while there is much to be proud of in the contributions the Indian region has made to mathematics over the centuries, communicating this to 18 and 20 year olds requires serious engagement with the questions of why it should be taught to them, what parts should be taught to them, and how the selected parts should be taught. Ultimately none of it can be placed in curricula in isolation, without relating to whatever else is being taught. Rather ironically, the curriculum proposed makes it look as if all Indian mathematics is only of high school level, since it has not been connected to developments that came after. *All this requires significant debate and discussion among the teaching community, and without any consensus among them, no curricular decision of this kind can be made.*

A student learning abstract algebra or differential equations and encountering *Kuttaka* and *Chakravala* in the same semester would consider them to be trivial and a waste of her time, without understanding the historical context in which they were proposed, thus achieving the exact opposite of the pride which was intended to be conveyed. Further, history of mathematics involves accounts of knowledge transmission across societies and cultures, ignoring these in the classroom will only develop uncritical, unthinking consumers of information among our students.

It is also ridiculous to see such “historical” courses as options among electives to be chosen by students along with mathematical ones such as calculus of variations or skill based ones such as computer programming. In what sense is this a choice? Why would a student then choose calculus of variations where getting a good grade would be difficult whereas it might be easy to memorise items in “Bharatiya” mathematics and get top grades? (Indeed, what questions would be asked in an exam on this subject?) Rather than encouraging students to struggle and learn in depth, we will encourage superficial learning.

It is instructive to consider mathematics curricula from countries such as China, Iran and Greece which are also ancient civilizations, take pride in their history, and have also made stellar contributions to mathematics and science. But still, they have found it to be beneficial for their students in mathematics to learn the subject matter as we know it today, rather than by choosing bits and pieces of mathematics whose only reason for choice is that they were discovered in

their particular geographical region. They do engage seriously with their history of mathematics, but not in their school and undergraduate classrooms.

3. Learning objectives and pedagogic means

While the stated intention of the proposed draft curriculum is to implement a curriculum that is based on well-defined learning outcomes, little of it has been achieved in the proposal. Instead, the courses and syllabi offer collections of information items. This will only encourage memorisation of information items. If moving away from rote learning is a stated objective of the NEP 2020, we will need mathematics curricula that provide coherence and analytical skills, enabling assessment that is based on conceptual practice.

Within India we have many undergraduate programs in ISI, CMI, IISERs, IISc and IITs, having curricula decided by working mathematicians who also teach at undergraduate and graduate level. Stepping out of India, one can simply pull up UG curricula from many different countries. We can learn from all these curricular practices and articulate learning objectives as well as syllabi that achieve coherence.

The world is moving towards mathematics education that is inquiry based, problem based and project based, enriched by the use of technological tools for visualisation, reasoning and symbolic computation. Curricula cannot be divorced from pedagogic practices of this kind; instead, curricula that enable and encourage critical thinking are needed. In the Indian context, mathematics in the university system is plagued by crude memory based assessment, and this cannot be changed without curricula that do not compromise on conceptual understanding. The proposed draft is entirely lacking such conceptual structure.

4. Specific comments

- Core mathematical competence has been compromised in this curriculum design, and this needs serious attention.
- Real analysis (subsuming multivariable calculus) can be spread out over three semesters and learned thoroughly (as of now, they are seeing properties of real numbers in their fourth year!).
- Linear algebra (matrix theory) can be spread out over two semesters. Algebra (Groups, with perhaps also some study of rings and fields) can also be spread out over two semesters (and subsume the “Theory of equations”) These are the fundamental themes in mathematics that one can and should learn at this level.
- Some important add-ons are discrete mathematics, probability and statistics, algorithms and programming.
- Many courses should be kept in electives, and offered where they can (e.g., complex analysis, topology, stochastic processes, PDE, cryptography, optimisation theory etc). Mathematics of machine learning may be welcome, but linear algebra simply cannot be relegated to be a part of machine learning.

- The study of probability and statistics can help students in a wide range of applications, but developing the required skills would require at least two well designed courses in sequence.

In general, the study of mathematics is not indexed by authors. We do not study topics chronologically in the sequence of mathematicians' contributions. This is important since we have learnt from all the modern developments, and teach students with the benefit of such wisdom. Hence courses on specific mathematicians of the past such as Brahmagupta (however great he was) is not right. Nor is it right to add a course on Ramanujan, whose enormous contributions can only be appreciated in their proper mathematical context. Even understanding his contributions would require learning number theory and analysis seriously. Indeed, all the courses proposed as "Bharatiya mathematics" in some form or another should be removed and replaced by a single well designed course on philosophy and history of mathematics, highlighting contributions from the Indian region. If required, two such courses can be offered, with the latter offering more historical data and analysis.

A number of courses have been listed in the format "Mathematics in XYZ" with options among curricular areas such as Physics, Chemistry, Life-Sciences, Banking, Finance, Business and Management, among the arts such as Music and Drama and Arts, but also rather strangely, Sustainability and Psychology, and bizarrely, Meditation. The content of these courses hardly clarifies why it requires semester long courses to teach them, or what educational purpose is to be achieved. This seems to be a mechanical exercise in offering wide applications of mathematics and providing a "holistic" approach, and achieving neither. There is also the question of who has the competence to teach these courses. All these courses should be dropped and replaced by a few well defined courses such as Mathematical methods for the physical sciences, Mathematical methods for the life sciences, Mathematical methods for the social sciences and Mathematics and the fine arts. Such courses are taught in many parts of the world, and we can learn from them, designing new ones as we need.

5. The teaching community

Finally, any curricular reform cannot be implemented without its ownership by the teaching community, supported by the availability of good quality educational resources and the administrative system being in alignment. When the UGC offers a model curriculum in mathematics, we hope that the rationale for making changes will be shared with the very large community of mathematics teachers and implementation will follow only after their acceptance. Moreover, every new course proposed should be backed by good quality educational resources, which teachers will need for their own preparation and subsequent classroom teaching.

6. A forward looking curriculum

Mathematics occupies a foundational space in knowledge systems and higher education seeks to provide students with not only mathematical skills but also an appreciation of the unity and structure of mathematics, of what makes it so abstract and yet so immensely powerful. They

need to function in the knowledge economy applying mathematics and extending the range of applications. Some of them need to go on to create mathematics and enrich the discipline. Many of them will become mathematics teachers and build future generations. Some will have careers not yet envisaged. Moreover, life in the 21st century poses new forms of uncertainty and challenge for the young: climate change, environmental degradation, the invasion of the digital world into the physical, and more. Higher education needs to create problem solvers who can meet the challenges confidently and with appropriate intellectual tools. The curricular pathways needed for all these possibilities require considerable flexibility in our higher education system, which is lacking right now. It is in this context that we expect a new model curriculum to provide directions for the higher education system, one that seeks to achieve global standards of excellence.

In the Indian reality, there is also a grim reminder: the poor participation of students belonging to the socially and economically disadvantaged sections of the society in higher mathematics, indicating prevalent forms of exclusion. A new policy, curriculum and implementation, offer hopes of addressing this issue in earnest.

From this perspective, the proposed draft is deeply disappointing as there is little that is forward looking, nothing that prepares students for socio-economic or intellectual life in the 21st century. On the other hand, whatever strengths the existing curriculum has may well be annulled if the new curriculum takes effect.

We need a mathematics curriculum that prepares the student to meet the challenges of the future by fostering problem-solving, adaptability, and the ability to apply concepts to real-world contexts. This demands a curriculum that incorporates pedagogic means such as inquiry-based learning, collaborative problem-solving, and use of technology for exploration and visualization. Pedagogy for the undergraduate curriculum needs more serious thought and cannot be treated as an afterthought.

We sincerely urge the UGC to drop the proposed draft curriculum in its entirety, and constitute a new committee to propose the undergraduate mathematics curriculum. We need a curriculum that emphasizes reasoning, proof, problem-solving, and connections across mathematical domains, one that is forward looking and builds a strong future for our students.