



ΕΛΛΗΝΙΚΗ ΔΗΜΟΚΡΑΤΙΑ

**Α.ΔΙ.Π.**

ΑΡΧΗ ΔΙΑΣΦΑΛΙΣΗΣ ΚΑΙ  
ΠΙΣΤΟΠΟΙΗΣΗΣ ΤΗΣ ΠΟΙΟΤΗΤΑΣ  
ΣΤΗΝ ΑΝΩΤΑΤΗ ΕΚΠΑΙΔΕΥΣΗ

HELLENIC REPUBLIC

**H.Q.A.**

HELLENIC QUALITY ASSURANCE AND  
ACCREDITATION AGENCY

## EXTERNAL EVALUATION REPORT

DEPARTMENT OF MATHEMATICS

UNIVERSITY OF PATRAS

September 20, 2013



**European Union**  
European Social Fund



MINISTRY OF EDUCATION & RELIGIOUS AFFAIRS, CULTURE & SPORTS  
MANAGING AUTHORITY

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### **External Evaluation Committee**

The Committee responsible for the External Evaluation of the Department of Mathematics of the University of Patras consisted of the following five (5) expert evaluators drawn from the Registry constituted by the HQAA in accordance with Law 3374/2005:

1. Professor Gerasimos Ladas (President)  
University of Rhodes Island, Department of Mathematics, USA
  
2. Professor Stavros Garoufalidis  
Georgia Institute of Technology, Department of Mathematics, USA
  
3. Professor Athanasios Papadopoulos  
Institut de Recherche Mathématique Avancée, Université de Strasbourg, FRANCE
  
4. Professor Panagiotis Souganidis  
University of Chicago, Department of Mathematics, USA
  
5. Professor Stephanos Venakides  
Duke University, Department of Mathematics, USA

## ***Introduction***

### I. The External Evaluation Procedure

The committee arrived at the University of Patras in the afternoon of Monday September 16, 2013, and was welcomed by the University Rector, the Dean of the School of Sciences, the Department Chair and the Internal Evaluation Committee. The committee spent the afternoon of Monday, and the entire days of Tuesday and Wednesday attending presentations, having meetings with faculty, students and staff. The visit concluded with a meeting with rector G. Panagiotakis, chairman N. Tsantas, professor D. Georgiou, (OM.E.A.), professor P. Pintelas, professor P. Tzermias and professor J. van der Weele, chair of the internal evaluation committee.

The following presentations were attended

- Division of Pure Mathematics, by Professor A. Kotsiolis
- Division of Mathematics Education, History and Philosophy of Mathematics, by Assist. Professor P. Karazeris
- Division of Applied Analysis, by Professor V. Papageorgiou
- Division of Computational Mathematics and Informatics, by Assoc. Professor T. Grapsa
- Division of Statistics, Probability and Operations Research, by Assoc. Professor E. Makri
- Professional training activities and student/faculty mobility, by Assist. Professor A. Arvanitoyeorgos
- Departmental Undergraduate Teaching Curriculum, by Professors P. Tzermias and P. Pintelas)
- The Mathematics Department, by Assoc. Professor N. Tsantas
- Departmental Postgraduate Teaching Curriculum, by Assoc. N. Tsantas
- The Internal Evaluation Report, by Professor J. van der Weele and Assoc. Professor D. Georgiou

The committee held meetings with the following

- Faculty members (in each division separately, as well as in private)
- A group of 6 outstanding undergraduate students, a Gold and five Bronze winners of the South East European Mathematical Olympiad for University Students
- A group of 8 students in the M.D.E. (Masters) program
- A group of 4 students in the Ph.D. program
- The 6 staff members of Grammateia
- 4 volunteered undergraduate students

The committee visited

- The central library of the University

List of Reports, documents, other data examined by the Committee.

- Report of internal evaluation, December 2011
- Additional data provided by the department at the request of the committee including 2-page CVs that most faculty were willing to share
- A guide of course offerings at the undergraduate, graduate and doctoral level 2007-2012 (Οδηγός προπτυχιακών και μεταπτυχιακών σπουδών)
- Documents containing the most important research results by faculty, provided by the Department
- The Undergraduate, Graduate and Doctoral program guides
- University statistical data provided by the office of the rector
- Statistical data of courses
- Electronic and paper copy of the detailed presentation regarding education and research
- A list of seminars of the department.

The committee found the above documents to be complete and informative. Any information requested by the committee, was promptly provided.

## A. Curriculum

*To be filled separately for each undergraduate, graduate and doctoral programme.*

### UNDERGRADUATE PROGRAM

The undergraduate mathematics curriculum is divided in two groups of courses, broadly described as mandatory and elective. For a Degree in Mathematics to be conferred, a student must pass a total of thirty six courses. Of these courses,

- 19 belong to the first category and are mandatory for all students (μαθήματα κορμού).
- 8 belong to the second category and are mandatory only for the students of the particular concentration that the student has chosen (μαθήματα κατεύθυνσης).
- 9 belong to the second category and are free electives.

There are serious concerns in the undergraduate program, stemming from

- high student course failure rates reaching 80%,
- abnormally long graduation time, averaging 7.3 years, in a program that should normally be completed in 4 years.

A main factor of these disturbing statistics involves the curriculum. Entering students no longer have the preparation in mathematical definitions and proofs obtained through high-school training in plane Euclidean geometry that former students received. As a result, rigorous analysis and algebra in the first semester pose an obstacle that shakes student confidence and drives students away from the classroom. The effect is magnified by the lowering of the admission standards over the years, by the decompression following the entrance examinations (πανελλαδικές) and by the transition to large classes of 150 students. In order to correct these deficiencies, serious curricular changes in the program are required and we need to do our best on this front.

The following observations are taken into consideration.

- Two courses that introduce highly demanding concepts and the notion of rigorous proof, “Introduction to Algebra and Set Theory” and “Mathematical Analysis I” are being taught in the first semester. This hits the students with a hammer and stands as a serious obstacle to their smooth transition to university education.
- The conceptual difficulty and amount of abstraction in “Introduction to Algebra and Set Theory” is greater than the one encountered in the subsequent course of “Linear Algebra I”. Their order should be exchanged.
- An introduction to set theory appears to be taught in too many courses; teaching it only as part of a single course should be sufficient. “Introduction to Algebra” is not the appropriate course.
- The content of the first semester course “Analytic Geometry” does not suffice to take a full semester.
- The sequence in ordinary differential equations requires complete reorganization. As it stands now, the students spend a year learning computational facts without much theory. Given the background of students, we recommend that the current courses are combined into one by cutting some of the material. The instructor should also make an effort to introduce some computer/calculation-type tools so that the students can understand via direct computations the structure of the solutions. This amounts to a typical second year one semester course in a typical mathematics undergraduate program in the United States based on a book like Boyce and Di Prima. After these changes, the current second semester can become a more advanced class of ODE where the students are introduced to basic theoretical concepts like existence, uniqueness, continuous dependence, linearization and stability properties with some proofs. A good reference is the book by Brauer and Nohel.
- Students should be given a flavor of modern research during their undergraduate studies. The department should include some undergraduate courses on current research that would prepare the future Ph.D. students and close the gap between undergraduate and graduate education.
- We invite the department to make similar considerations throughout the entire curriculum.

**In order to respond to the real needs of entering students, we make the following recommendations:**

- Analysis I should be moved to the third semester.
- Linear Algebra I should be moved to the first semester.
- Analytic Geometry does not include sufficient material for a semester-long course and should be abolished.
- A two-semester introductory course sequence, “Series and Multivariate Calculus” and “Vector Calculus” should be taught in the first year with emphasis on computations and only outlines of some basic proofs. A brief description of this course should include a quick review of the concepts of derivatives and integrals of functions of one variable, calculation of extrema, an intuitive notion of convergence of sequences and series including the basic tests of convergence, basic geometry of curves and surfaces, partial derivatives, extrema of multivariate functions, multiple integrals, line and surface integrals, and the divergence and Stokes theorems. Courses with material overlapping with the above should be removed.

**The recommendations below relate to subsequent years of instruction.**

- Following the first year preparation as described above, the sequence of four rigorous analysis courses should be compressed to three.
- Restructure the teaching of ordinary differential equations as recommended above.
- The numerous mechanics courses should be combined at most into a sequence of two.
- The courses on relativity and quantum theory as described belong to a physics department and should be eliminated.
- The ten courses of the Didactics Division should be abolished. They should be replaced by a weekly year-long seminar on the “Fields of Mathematics” which students as well as local mathematics high school teachers and the general audience are encouraged to attend. In particular, every broad field of research in mathematics and its concepts should be presented in an attractive and intelligible way. For instance, what is a group? What is algebraic geometry? What is differential topology? What is a manifold? What is a PDE? What is mathematical modeling? What is graph theory? What is combinatorics? What is a random variable? How are probability and statistics used in medicine? What is an inverse problem and how it is related to imaging? What is special relativity? What is general relativity? What is quantum mechanics? What is mathematical biology?

## GRADUATE PROGRAM

A quick look at the descriptions of the courses (for instance in pure mathematics) reveals the existence of very specialized courses that do not connect with the courses preceding or succeeding them as well as the absence of some basic beginning graduate-level courses. There is a tendency, especially among more senior members of the department, to cover their teaching load through such courses. Given the real need for teaching hours in the heavily populated lower-division courses (where freshman enrollment exceeds 300 students and sophomore enrollment sometimes exceeds 1000 students), **this practice needs to stop.**

The curriculum associated with the master studies is reasonable. Some students pointed out that there is a gap between the mathematics preparation at the undergraduate level in Patras and the expectations in the graduate program, in other words the undergraduate training does not prepare the entering doctoral students for their study. The committee believes that the gap is between the curriculum on paper and what is actually taught and assimilated by students. **The curriculum and material taught should be at the level of a master program of a research university in the US.**

In response to our focused questions, students explained that they had to retake in mathematics as many as seven courses

taken outside mathematics raising their total course load from 12 to 19. For example masters students pointed to us a problem of accreditation of mathematics and statistics courses taken at the department of economics, and required to be taken again at the department of mathematics, in addition to the masters course load, in spite of the fact that the level of the course was very similar. This brings up the important issue of course cross-listing that is very common in foreign universities. Courses taught in different departments covering the same material at the same level in the same university **should be cross-listed**. In any case, at the time of application, **students should have a clear understanding of all the requirements in the masters program**

The committee found that the typical length of time for receiving the masters degree was between 2.5 and 3 years. As in the undergraduate program, **every effort should be made so that students graduate in a timely fashion**.

Lack of funding for professional travel (such as participation to conferences) was brought to the attention of the committee members multiple times and persistently, by doctoral students. **A serious effort is needed to correct this problem**.

## ***B. Teaching***

Based on the student evaluation form summary that was presented to us, the quality of instruction is good in general. This was also our impression, after discussion with a few undergraduate students. The department has trained some excellent students. The committee applauds the efforts to prepare top students (we had the chance to speak to them in person) for international mathematical competitions and for the outstanding performance of the students in these competitions. All six of them received medals, one Gold and five Bronze. On the other hand the committee also felt that the department set the bar low for the average student in terms of prerequisites, attendance, homework and midterms.

**The following recommendations apply to the way courses are run and should be implemented.**

- All courses with large enrollments should be broken into sections, each having at most 50 students. The exercise training classes should have a maximum of 25 present students. Cases where there is a serious discrepancy between enrolled and attending students should be reported to the chairman who would be responsible for corrective action. If the discrepancy cannot be corrected within the department, the issue should be resolved by the dean (κοσμητορας).
- In multi-section courses, there should be a common textbook and common syllabus, a common final exam decided by the instructors, and uniform final exam and final course grading. In courses with three or more sections, one of the instructors should be the coordinator. Finally to give students a feedback as well as to increase attendance each section should have two in term exams which will be graded and count as at least 40% of the grade.
- Presently, students receive their books well into the semester. This is not only unacceptable, it is shameful. A solution needs to be found. At the very least, an immediate measure should be that several copies of the textbooks are in the library on reserve.
- The committee found that students appreciate access to instructors. It should be enforced by the chair, that all faculty post office-hours on their office doors every semester and keep these hours. It is to be understood that it is the instructor duty to promptly respond to reasonable email requests by students.
- Courses with low attendance (low being determined course by course at the department level) should be canceled in the first week of classes. The instructor should be used to alleviate teaching in an overloaded course by creating an additional section. The students should be aware of this policy so that they know the consequence of their non-attendance.
- Every student of the department of mathematics should have a faculty advisor, who should meet with their advisees at least once in the beginning of the semester, and should broadly be accessible by appointment.
- Students should be allowed to enroll in at most 6 courses per semester. For enrollment in more courses, a special permission from the department should be required, as well as signature of the advisor.
- A question that arose in the committee is how large is the gap (it always exists) between the advertized course description and the student understanding of basic concepts of the course. This is a common occurrence everywhere. It would be desirable to find ways to control it.
- The committee feels that **there are many “useless” classes taught when the faculty should concentrate on teaching quality and smaller class sizes.**

- Last but not least, courses should be **labeled with numbers indicating the level of difficulty**. IT IS AMAZING THAT THIS HAS NOT YET BEEN INSTITUTED UNIVERSITY-WIDE.

## C. Research

*For each particular matter, please distinguish between under- and post-graduate level, if necessary.*

Research is the most important element for the ranking of a university worldwide. Research in mathematics should be of high level in the country where mathematics was born. It is well-known that the majority of the internationally known Greek mathematicians work abroad and it is legitimate to ask why this is the case. The committee believes that if the working conditions at the departments of mathematics in Greece were different, many of them would have preferred to work here. Mathematics is not an expensive discipline unlike all other natural sciences. Creating mathematics university groups in Greece that operate under conditions and by-laws similar to those in top American and European universities is possible. It is justifiable that our standards should be high in judging the Department of Mathematics of the University of Patras.

Based on the number of publications in good quality journals, as determined by international journal rankings, **few faculty members are very active, some are relatively active, and about half of them are inactive.**

A disproportionately large number of selected publications which were presented to the committee appear in journals that are not even listed in the ranking lists of mathematical journals.

Another serious problem area is that **half of the department received their doctorate at the University of Patras**, which is also their sole employer. Such inbreeding is a demonstration of a lack of openness in the hiring policy.

A serious area of concern that can be immediately corrected is **the fragmentation of the department into so-called divisions (τομεις)**. The divisions have degenerated into mini-centers of territorialism and self-interest. This has serious negative impact on hiring, research, teaching, administration and good citizenship. The division is artificial, a historic relic from the past that should be abolished immediately. There is no financial cost on such a decision, which will bring together the members of the department, and bring the department closer to the 21st century. We have the good feeling that our visit has promoted this way of thinking among our colleagues in Patras.

It is commonly understood that research funding from resources of the Greek government is scarce. Although this is not to be passively accepted, it is essential, nevertheless, for the university to intensely exploit funding possibilities from EU sources. The department would also greatly benefit from the use of department funding in a way that supports travel to conferences and purchase of shared equipment instead of e.g., individual printers. The committee was pleased with the rector's verbal commitment to this effect.

### **D. All Other Services**

*For each particular matter, please distinguish between under- and post-graduate level, if necessary.*

It is the impression of the committee that the department's administrative staff (γραμματεία) discharge their duties effectively. They operate in adverse conditions, having to interpret with minimal legal advice, laws that are vague, constantly changing and having to wait to be instructed when and whether a law will be implemented. The committee explained to the supervisor and the entire staff that standard annual evaluations would be beneficial to all of them. We heard from them that the graduate program which does not yet belong to the expanding electronic system of the university, will soon be part of it. It should be mentioned that the meeting with the secretarial staff took place while they were on strike.

The central university library is pleasant, spacious and comfortable and the students use it efficiently in order to study. It contains a good collection of periodicals and books, there are several electronic subscriptions to journals and a large number of computers are placed at the disposal of the users. The personnel is helpful, friendly and knowledgeable.

The web site of the department has been seriously upgraded to become a friendly window of communication between the department and the world. We also recommend that an internal intranet database be created in which faculty enter their activities annually, making departmental statistics and planning and internal evaluation a much simplified task.

Due to lack of time, we were not able to visit all labs. However, we studied the presentations provided to us, and we spoke with most of the heads of the labs.

### **E. Strategic Planning, Perspectives for Improvement and Dealing with Potential Inhibiting Factors**

*For each particular matter, please distinguish between under- and post-graduate level, if necessary.*

We are optimists and believe that the country is moving to slowly overcome its financial crisis. In this spirit, it is important for the department to take advantage of the recommendations of this committee and make the appropriate modifications to the program. This will have a positive effect on the visibility of the department, important for forthcoming accreditation of university programs that may affect the very existence of these programs.

Hiring procedures should be established so that replacement hires are world class mathematicians. This crisis offers a unique opportunity for the department to enhance its research status spectacularly and move towards placing itself by the side of great European institutions. Mathematics is an area in which Greece can and should compete in the

world scene. This opportunity to restore some of the wounded pride of Greece must be recognized and set as a goal at the institutional and government level.

## ***F. Final Conclusions and recommendations of the EEC***

*For each particular matter, please distinguish between under- and post-graduate level, if necessary.*

For two years, in different committees and in four evaluated mathematics departments, we have been observing similar patterns in need of urgent improvement. It is a serious concern that mathematics departments do not implement changes in advance of their own evaluation by making make use of earlier recommendations to other departments. Regrettably, university administrations do little or nothing to enforce such implementations.

The committee finds the Department of Mathematics of the University of Patras to be weak in almost all areas, embodying malfunctions some of which are linked to the weakness of the Office of the Rector. Most shortcomings originate from the law as it was before the recent drastic changes. Creating “figurehead” department executives with tied hands, the older law entrusted the department governance to collective bodies that failed to pursue quality and were often politically motivated. The older law embodied and cultivated a perverted societal notion of equality and democracy. **Viewed as a violation of the ideal of equal treatment, the reward of quality as an incentive for achieving institutional excellence was (and in many quarters is) thus considered heresy.** The idea of disincentive was equally abhorrent. Thus, following student admission, the student status was preserved as an eternal right even for academically inactive students. The chaos in enrollments and in departmental planning and the cost to society due only to such “eternal” students became a way of life.

The committee was frustrated and deeply disappointed to find the mentality of the older law still prevalent in the Office of the Rector. Although the rector was helpful on a departmental occasion and promised solidly a requested restructuring of the department funding (with no change to the total amount), the committee's request to the rector to implement the new law on eternal students, something that should and can be done immediately, was met only with vague assurances about a future time. When the rector, with his hands freed by the recent changes of the law, hesitates to take advantage of this freedom to simply implement the law, how can he oversee the department taking advantage of *its* newly given operational freedom to solve problems that have been plaguing it for years?

A different university-wide problem that defies common sense, is that students still receive their books long after the beginning of classes. They are awakened from a state of academic indifference and inactivity only a few weeks before the final exam. Unfortunately, the intellectual effort required to absorb the material of a semester cannot be compressed into just a few weeks. The outcome is a weak program and graduation times that far exceed the ones for which the undergraduate program is designed. Additional factors that concentrate student academic effort in the last weeks of classes are the lack of academic pressure early in the semester (in a well-functioning system, this is typically created by in-term exams and homework), the decompression felt by the students following success in the entrance exams and finally the disorganization resulting from large admissions numbers.

The fragmentation of the department into five sectors is anachronistic and deeply harmful to the cause of achieving excellence. In a world in which the quality of a department is measured by the research quality of its faculty, in a world in which one looks all over trying to recruit the best, half of the faculty of the Mathematics Department is made up of their own former students. Clearly, each sector has been hiring new faculty without serious quality control from the other sectors, who expect the return of the favor in their own hires. In most research universities in the US, there is a university "appointments and tenure committee" that examines each departmental faculty hiring decision in order to block practices like this and ensure top level hiring; faculty of the department in which the appointment occurs are excluded from the committee. When at some point a position opens up in the department, there is an opportunity. Due to the current world crisis, there are lots of very good mathematicians looking for a job. Even a top international recruitment that may provide world class leadership to the department is possible and something that the committee encourages.

The fragmentation of the department relates to teaching as well. Apparently, who teaches what courses and from what textbook, a simple matter in a well-functioning organization, is an arena of conflict in the department, only resolved through the institution of sectors. The committee is sharply critical of both the existence of such an "issue" and of its resolution through fragmentation. What courses to teach is easily resolved by going through the bulletin of some top research universities in the US and following their lead. Instructor assignment should place the student benefit ahead of faculty self-interest.

The department would be well-advised to have a look into what is happening with universities world-wide. New communication channels open up, institutions are looking outside to broaden their view and compete nationally and

internationally, state funding (including salaries) is tied to quality, the promotion of interdisciplinary research and study is the norm (which constitutes exactly the opposite of departmental fragmentation), the leading universities of our neighbor Turkey, following the lead of the US and W. Europe, are adopting research and education structures still unimaginable in Greece. In this world, the department seems to have been living in a black hole, still trying to grapple with the demons it has created over years of in-fighting and lack of vision.

The committee is facing a system that is not simply diseased. It has cancer that has spread and now it must be cured. Fortunately, starting the process of cure is possible immediately. The change in the law allows fresh air and opens the road to new opportunities. There is a number of very good people in the department, both young and older. Furthermore, the sum of all faculty as an imagined truly collaborative team is worth much more than the department can claim with its current way of functioning. In short, if the department wants, the department can. **The committee was encouraged and pleased to discern a will to act positively** and our recommendations are primarily for within the department. **At a level above the department, no such spirit of positive change** was observed. Our suggestion to the higher level is: “For the sake of the university, your country, your children and your own self-esteem, implement the law”.

A number of recommendations and changes are **highlighted** in the main body of the review. The committee recommends that actions for their implementation **must begin immediately**. The **committee recommends the same** for the restructuring of the analytic geometry/analysis/algebra sequences as described in the body of the report. In summary the committee feels that the following list of actions and measures will have a serious positive impact on the department’s pursuit of excellence.

- Abolish the five divisions (τομεις).
- The number of 300+ mathematics students, admitted each year by the Ministry of Education, is a multiple of the number recommended by the department. To a large degree it consists of students who are not mathematically inclined. This produces a large population of students who become inactive or inexcusably negligent of their duties, placing a large stress on organization and teaching. At the very least, the University administration **MUST** discontinue inactive students, now that the legal obstacles for doing this have been removed. Apply the law regarding inactive students **IMMEDIATELY**. Their presence has a destructive influence in faculty hiring and in the planning and teaching of the undergraduate courses.
- When hiring, advertise widely and recruit the best available candidate across all research areas.
- Actively pursue grants from domestic and especially EU sources. Increase visibility of the department by cultivating collaborative work with domestic and foreign scholars, preferably with visits in place.
- Plan and utilize optimally the rector's verbal commitment to restructure department funding in a way that supports travel to conferences and purchase of shared equipment.
- Offer undergraduate courses based on student needs and not based on faculty specialization or teaching preference. Teach them at the level they are taught in research universities in the US and W. Europe.

Abolish or modify accordingly all or most current courses that do not comply with this standard.

- Specify the textbook of undergraduate courses at the department level, choosing the most suitable for the course independently of instructor. Make a textbook change only if it is truly warranted.
- Reorganize, merge and abolish courses as specified in the body of the report.
- Enforce maximum enrollment to 50 students per class section and enforce attendance in mandatory courses by two in-term exams and regular homework.
- At the beginning of each semester, provide the students with a written syllabus, outlining the course description, textbooks, exam dates and grading policy, homework policy and office hours. The syllabus should be available in e-class.
- The curriculum and material taught in the graduate program must be adjusted to be at the level of master's program of a research University in the USA.

The committee wishes to acknowledge the fact that it was very well received by the faculty, the departmental administration and staff, the dean of the School of Sciences, the rector and vice-rectors of the university. In particular, we wish to acknowledge the efficient organization of the material and activities of the committee by the Chair of the department and the Chair and members of the Internal Evaluation Committee.

### The Members of the Committee

Name and Surname	Signature
1. _____	
2. _____	
3. _____	
4. _____	
5. _____	