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HELLENIC REPUBLIC
H.Q.A.
HELLENIC QUALITY ASSURANCE AGENCY
FOR HIGHER EDUCATION

EXTERNAL EVALUATION REPORT

DEPARTMENT: Electrical and Computer Engineering (HMMY)

UNIVERSITY /TEI: National Technical University of Athens (EMII)

Version 2.0
March 2010

TABLE OF CONTENTS

The External Evaluation Committee

Introduction

I. The External Evaluation Procedure

- Brief account of documents examined, of the Site Visit, meetings and facilities visited.

II. The Internal Evaluation Procedure

- Comments on the quality and completeness of the documentation provided and on the overall acceptance of and participation in the Quality Assurance procedures by the Department.

A. Curriculum

APPROACH

- Goals and objectives of the Curriculum, structure and content, intended learning outcomes.

IMPLEMENTATION

- Rationality, functionality, effectiveness of the Curriculum.

RESULTS

- Maximizing success and dealing with potential inhibiting factors.

IMPROVEMENT

- Planned improvements.

B. Teaching

APPROACH:

- Pedagogic policy and methodology, means and resources.

IMPLEMENTATION

- Quality and evaluation of teaching procedures, teaching materials and resources, mobility.

RESULTS

- Efficacy of teaching, understanding of positive or negative results.

IMPROVEMENT

- Proposed methods for improvement.

C. Research

APPROACH

- Research policy and main objectives.

IMPLEMENTATION

- Research promotion and assessment, quality of support and infrastructure.

RESULTS

- Research projects and collaborations, scientific publications and applied results.

IMPROVEMENT

- Proposed initiatives aiming at improvement.

D. All Other Services

APPROACH

- Quality and effectiveness of services provided by the Department.

IMPLEMENTATION

- Organization and infrastructure of the Department's administration (e.g. secretariat of the Department).

RESULTS

- Adequateness and functionality of administrative and other services.

IMPROVEMENTS

- Proposed initiatives aiming at improvement.

Collaboration with social, cultural and production organizations**E. Strategic Planning, Perspectives for Improvement and Dealing with Potential Inhibiting Factors**

- Short-, medium- and long-term goals and plans of action proposed by the Department.

F. Final Conclusions and recommendations of the EECon:

- The development and present situation of the Department, good practices and weaknesses identified through the External Evaluation process, recommendations for improvement.

External Evaluation Committee

The Committee responsible for the External Evaluation of the **Department of Electrical and Computer Engineering** of the **National Technical University of Athens** consisted of the following five (5) expert evaluators drawn from the Registry constituted by the HQAA in accordance with Law 3374/2005:

1. **Prof. Kim on P. Valavanis** (Coordinator)
University of Denver, USA
2. **Prof. Vassilios G. Agelidis**
University of New South Wales, Sydney, Australia
3. **Prof. Christos Christopoulos**
The University of Nottingham, U.K.
4. **Prof. Costas N. Georgiades**
Texas A&M University, USA
5. **Prof. Athanasios Manikas**
Imperial College London, U.K.

N.B. The structure of the “Template” proposed for the External Evaluation Report mirrors the requirements of Law 3374/2005 and corresponds overall to the structure of the Internal Evaluation Report submitted by the Department.

The length of text in each box is free. Questions included in each box are not exclusive nor should they always be answered separately; they are meant to provide a general outline of matters that should be addressed by the Committee when formulating its comments.

Introduction

The plan of the External Evaluation Committee (the EEC or the Committee) was to visit the campus facilities from 21/10/2013 to 23/10/2013, in order to evaluate the School of Electrical and Computer Engineering (ECE) of the National Technical University of Athens (NTUA). The aim was to meet on campus with academic staff, administrative and technical support staff, undergraduate and postgraduate students, alumni and other stakeholders such as industry representatives who interact with the School and have hired its graduates for employment. However, due to strikes in the University sector in Athens, the Committee was informed that all meetings and interviews will take place in the H.Q.A.A offices. Regardless, the Committee requested to visit the campus and tour facilities and laboratories. However, due to the strike, this was not possible. It should be noted that the majority of the Committee members are aware of the range of resources and facilities available to the School.

After the EEC's arrival in Athens, the Committee first assembled at 9.30am on Monday (21/10/2013) in the H.Q.A.A offices where, after a short briefing by H.Q.A.A. representatives, met the Dean of the School of Electrical and Computer Engineering, Prof. D. M. Tsamakis. Following introductions, Prof. Tsamakis presented an overview of the School. This was followed by two presentations about the School's undergraduate and postgraduate curricula. About a third of the ECE faculty members were present at the meeting, which was very encouraging and positive. The Directors of the 7 Sections (Τμήσις) of the School gave presentations about their Sections' activities, including course offerings at the undergraduate and graduate levels, research projects, publications, collaborations and services to, impact on, the Greek society and market. The meeting concluded at about 6 PM. Throughout the evaluation process, the former Chair and Vice-Chair of the School, Professors A.G. Stafylopatis and K Nikita were present and provided information and clarifications on the Internal Evaluation Report (2009-2010) that had been issued during their term of office.

On Tuesday, 22/10/2013, starting at 10 AM, the Committee and School's faculty members, including several new ones, met again at the H.Q.A.A offices. Faculty members gave additional presentations that went into considerable details on School's laboratories, undergraduate and postgraduate curriculum issues, educational programmes at the undergraduate and postgraduate levels, as well as a description of the overall School's research activities. The Committee commends the Dean and the faculty members for their positive attitude and overall willingness to collaborate in an open and transparent manner.

On Wednesday, 23/10/2013, additional presentations were given related to the support infrastructure of the School (PC Lab, Library, etc.) and the ERASMUS programme. The Committee also met with a group of undergraduate and postgraduate students (again, not on campus) who presented their views on educational, research, administrative and operational issues related to the School.

A detailed presentation of the Institute of Communications and Computer Systems ICCS (Ερευνητικό Πανεπιστημιακό Ινστιτούτο Συστημάτων Επικοινωνιών και Υπολογιστών-ΕΠΙΣΕΥ) activities, including funding, was given to the Committee. ICCS is a nonprofit Academic Research Body established in 1989 by the Ministry of Education in order to carry research and development activities in the fields of all diverse aspects of telecommunications, computer systems and techniques and their application in a variety of areas. ICCS is associated with the School of Electrical and Computer Engineering NTUA and is being supervised by the Hellenic Ministry of Education. The role of the ICCS to encourage and support faculty research activities was presented in detail by its Director. Based on the information presented to the Committee, the ICCS has demonstrated its capability of attracting competitive funding and operating as a self-funded entity. However, it appears that the 'future existence' of the ICCS is becoming unclear due to uncertainty in the higher education legal framework.

Finally the Committee met at the H.Q.A.A with the two Vice-Rectors, Professors Avaritsiotis and Moropoulou. Prof. Moropoulou presented the main features of the School and its ranking nationally and internationally. She also raised the issue of the administrative and support staff reduction, which is the subject of the current strike. Her position was that because of the wide spectrum of activities of the School, any substantial reduction in

administrative, technical and support staff would adversely affect its operations. The Committee had the opportunity to discuss these issues with the Vice-Rectors.

The Committee met alone on Thursday (24/10/2013) and Friday (25/10/2013) to complete its report. On Thursday afternoon the Director of ICCS hosted a working luncheon for the EEC where the Dean of the School and several faculty academic members were present. During the luncheon, several points related to the evaluation details were clarified. The atmosphere was very cordial and friendly, and several issues associated with higher education were freely discussed.

It is stated that the Committee was unable to meet with representatives of the administrative, support and technical staff because of the ongoing strike.

The Committee was disappointed that the School's Internal Evaluation Report was written in 2009-2010 and no updated version was available in advance of the EEC's visit. However, all presentations to the Committee were updated to reflect current and ongoing activities, including funding, publications, postgraduate students, impact of research, etc. Furthermore, electronic copies of the presentations were given to the Committee at the end of each day.

In summary, the Committee was provided ahead of the visit with a copy of the 2009-10 School's Internal Evaluation Report. During the visit the EEC was provided with extensive and very detailed documentation, copies of all presentations, and some data of the School's operations despite logistical issues due to the strike. Furthermore, the Committee was given access to web sites that included cumulative information about diverse activities. Academic staff provided additional evidence and information about each section's and research lab's activities. Finally, the Committee was given access to a site with about 3000 diploma theses in electronic form.

The Committee was disappointed that due to the circumstances the evaluation did not take place on campus.

A. Curriculum

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

APPROACH

- What are the goals and objectives of the Curriculum? What is the plan for achieving them?
- How were the objectives decided? Which factors were taken into account? Were they set against appropriate standards? Did the unit consult other stakeholders?
- Is the curriculum consistent with the objectives of the Curriculum and the requirements of the society?
- How was the curriculum decided? Were all constituents of the Department, including students and other stakeholders, consulted?
- Has the unit set a procedure for the revision of the curriculum?

UNDERGRADUATE CURRICULUM

According to the ΦΕΚ 86/07.06.1991, the mission of the School of Electrical and Computer Engineering is the education and graduation of engineers who deal with the design of systems for the generation, transportation, distribution, storage, processing, control and utilization of energy and information.

According to the documents received, "The main strategic objective of the School of ECE is to maintain and improve the NTUA ranking and its recognition as an internationally known technical university. This is accomplished through the School's focus on high quality education. The undergraduate curriculum is continuously reviewed and updated with new courses, aiming at providing students with the needed knowledge for a successful career or postgraduate studies".

The educational and research activities of the School of Electrical and Computer Engineering (ΣΗΜΜΥ) have been separated into seven (7) sections (τομείς) as follows:

- Computer Science
- Electric Power
- Electromagnetics, Electro-optics and Electronic Materials
- Industrial Electric Devices and Decision Systems
- Communications, Electronics and Information Systems
- Transmissions Systems and Material Technologies
- Signals, Control and Robotics.

According to the documents received, “goals and objectives of the undergraduate curriculum of the School focus on defining the role of the Electrical and Computer Engineer in modern society as the graduate who faces the challenge to participate actively in technological developments, by designing, developing, applying and managing continuously new technologies”.

The curriculum is delivered over a five year intensive programme with a suitable background of basic/fundamental knowledge from all the subject areas of the Electrical and Computer Engineer. The curriculum is overloaded with courses and also includes laboratory training, project work, a diploma thesis (Διπλωματική Εργασία) and, on occasion, non-mandatory internships (practical training). Overall, the curriculum is well-designed but more balance between theoretical and engineering/practical courses is needed in the first two years to motivate students on electrical engineering after the ordeal of the university entrance examinations.

The Committee commends the use of multiple methods to assess student performance in most courses. Only 17.5% of the courses have a final examination as the only way of assessing student performance. The use of the latest software tools to enhance learning is also commended. There are, however, some courses where the use of software tools will enhance learning. The number of software tools used in the PC Lab, although sufficient, could be enhanced.

The curriculum covers 10 semesters (5 years). In the first five semesters students attend mandatory courses, common to all students. The core curriculum builds the essential background and basic knowledge of all cognitive subjects of the Electrical and Computer Engineer. The next four semesters include selected courses from 10 streams depending on four specializations: Electronics and Systems; Information Technology; Communications; Energy. Students are allowed to choose combinations of streams concentrating in specific subjects of interest. The last semester focuses on the mandatory diploma thesis.

The School offers 222 undergraduate courses and, in order to graduate, students need to complete 59 equally weighted courses, 34 of which are mandatory courses and 25 are subject area technical courses from 10 streams. It is the Committee’s opinion that the curriculum is very course-intensive involving an excessively large number of courses (on average 6 courses per semester).

The curriculum is summarized as follows:

- Core programme (1st to 5th semesters) that is common to all students
- Section specialization (6th to 9th semester)
- Diploma thesis (10th semester)
- Practical Training, internship (optional)

The list of courses in the curriculum covers a wide range of topics from fundamental courses (i.e., mathematics, physics, basic computer science, computer engineering) to courses in Electric Power and Energy, Signals and Systems, Robotics, Communication Systems, Bioengineering, Electronics and Microelectronics, Materials, Computer Science and Engineering, as well as more advanced elective courses. The curriculum is diversified, extensive and broad. Although, after the fifth semester students have to follow specific course-streams, with only 4 electives, course-streams do allow students to build their own

academic profile, i.e. the same direction can be built by different course combinations. Students may choose a course-stream as full (7 courses, of which 4 are mandatory and the remaining 3 selected from a pool of 10-11 courses) or half (4 courses, of which 2 are mandatory and the remaining 2 selected from a pool of 12-13 courses).

The curriculum objectives, specialisations and course-streams were decided before 2000, through the School's general assembly decision process, after the recommendation of the undergraduate curriculum committee. Although the School has a Curriculum Committee the EEC did not observe a regular and systematic process of curriculum review for building on existing strengths and addressing identified weaknesses.

On interaction with the faculty members, it seems that there is no lack of equipment resources and space, although there are complaints about support teaching and laboratory staff.

The current course curriculum was designed to create a comprehensive and balanced five-year undergraduate programme that offers knowledge in the fundamentals of electrical and computer engineering. However, it is the Committee's opinion that the curriculum should be reviewed and should be restructured. The number of courses should be substantially reduced. Overlap between courses should be minimized, which may contribute to reducing the number of courses. It is the Committee's opinion that the curriculum should have at most 50 courses.

The Committee realizes that faculty members are aware of this need and they are committed to address and resolve this challenge. The specific procedure for the revision of the curriculum will follow the general assembly process. The 'timing' of this revision was not explicitly stated, nor was it described in the internal evaluation report, nor was it presented to the Committee. However, the School declared its intent to proceed with such a revision and the Committee encourages them to do so.

POSTGRADUATE DIPLOMA CURRICULUM

The School contributes to two Interdepartmental Postgraduate Specialization Diploma (Διατμηματικό Μεταπτυχιακό Δίπλωμα Ειδικεύσεως) degrees in collaboration with other University Departments. It currently has 280 student and these degree programmes include several different courses and a dissertation (project work). Students do not pay tuition fees. The total number of available courses is sufficient and covers diverse topics.

PhD RESEARCH CURRICULUM

The School offers Doctoral Degrees that require, in addition to the research, a total of 6 compulsory courses for students graduating from a five year programme or 10 compulsory courses for those coming from four year programmes. The number of postgraduate level courses is more than sufficient and covers a wide range of topics. Each of the School's Sections offers a separate list of courses.

Overall, the School currently has 1040 postgraduate students. 370 students follow the Interdepartmental Postgraduate Specialisation Diploma (Διατμηματικό Μεταπτυχιακό Δίπλωμα Ειδικεύσεως) degree cycle, and 670 students are doctoral candidates. The studies of some, but not many, students are supported by funded research projects. The average duration of doctoral studies is about five (5) years.

IMPLEMENTATION

- How effectively is the Department's goal implemented by the curriculum?
- How does the curriculum compare with appropriate, universally accepted standards for the specific area of study?
- Is the structure of the curriculum rational and clearly articulated?
- Is the curriculum coherent and functional?
- Is the material for each course appropriate and the time offered sufficient?
- Does the Department have the necessary resources and appropriately qualified and trained faculty to implement the curriculum?

The current curriculum follows, and it is constrained by, the stream-based structure of the School and may not serve the School's long-term goals sufficiently well. Although a considerable effort is made to connect theory, applications and systems through laboratory exercises, the Committee feels that the curriculum should have substantially fewer courses. If done correctly through avoidance of substantial overlap and better focus, the reduction in courses should not have a negative effect on the programme quality while at the same time reducing the average time to graduation. The latter goal should be a fundamental one as it has strong financial implications for the student as well as the Greek Taxpayer.

The structure of the curriculum is rational and clearly articulated in the School's Course Guide. It is overall coherent and it appears to be functional despite its inflexibility.

The Committee feels that in order to avoid content overlaps and repetitions, prerequisites should be enforced.

Due to the large number of courses it may be difficult to complete the degree in ten semesters. Only very well qualified, prepared, and motivated full-time students may be able to complete the curriculum. The average graduation time among active students (3008) is 5.6 years. However, the total number of students is close to 5000. Of major importance is the fact that several diploma theses result in fully refereed published papers in high impact technical journals and/or fully refereed international conference papers. However, in most cases the diploma thesis requires more time to be completed than the allocated six month period (10th semester) and this should be corrected.

The academic/teaching staff is very well qualified to deliver and implement the curriculum.

Postgraduate and doctoral programme

The Committee states that there is no 'approved funding mechanism' to support all postgraduate students. The School has limited funding for Teaching Assistants. As a result, postgraduate students are supported by externally funded projects. In addition, postgraduate students serve as laboratory demonstrators and coursework markers, thus acting as Teaching Assistants. There are a limited number of postgraduate fellowships allocated to the School by the Research Committee of NTUA and by the ICCS.

The School has a very impressive record of competitively funded research projects, which allows for postgraduate and PhD research student support and involvement in projects.

RESULTS

- How well is the implementation achieving the Department's predefined goals and objectives?
- If not, why is it so? How is this problem dealt with?
- Does the Department understand why and how it achieved or failed to achieve these results?

It appears that the overall mission, vision and long-term strategic planning of the School of Electrical and Computer Engineering will need revision and refocus, despite the fact that each section's objectives are clear. The Committee understands that Universities are in

transition due to the new legal framework for higher education and this creates issues in long-term planning. The Committee strongly encourages the School to develop a five year well-balanced strategic plan, even if it is not requested/required by the Ministry of Education. The Committee feels that such a plan is essential in spite and because of the current uncertainties. The strategic plan will help advancing the School's mission, vision and objectives. The School should define strategically chosen areas of focus to follow.

The overall implementation of the curriculum is satisfactory, despite some course overlap or repetition. Resources and space are sufficient – the Committee was pleasantly surprised with the fact that there were no complaints about space.

It was also stated that laboratory exercises are coordinated and monitored by postgraduate and doctoral students. An increase in the number of technical staff will remove this problem.

IMPROVEMENT

- Does the Department know how the Curriculum should be improved?
- Which improvements does the Department plan to introduce?

The Committee recommends that the School follows closely the procedures for curriculum improvement that are discussed in the Internal Evaluation Report (pages 15-16) and in the two reports issued by the Undergraduate Studies Committee, updates and enhances them to arrive at a current and working document on how to improve curriculum design, development, delivery and implementation.

However, regarding the implementation of the School's goals and objectives with respect to the undergraduate curriculum, the School understands the issues described above and has expressed its intent to deal with them through curriculum restructuring and reduction of the number of courses. Nevertheless, no specific timetable was presented to the Committee although in 2011 the School:

- Surveyed the faculty members of staff about their views on the undergraduate curriculum, and,
- Collected qualitative and quantitative curriculum data for analysis from the internet associated with a number of top UK, EU and North American Universities.

The Committee commends this exercise carried out in 2011 and encourages the School to proceed and revise its curriculum.

Furthermore, the Committee believes that:

- Better interaction and coordination with industry may enhance the curriculum, will stimulate research further, and may result in additional funding that will support more students.
- The School should develop and implement a policy for internships (practical training) within the next year.
- The inclusion of a subject course on entrepreneurship is commended.

Finally the Committee highly recommends the introduction to the curriculum of a "Group Project". This is before the final year project (diploma thesis) and it normally takes place in the penultimate year involving a number of students working together in various parts of a challenging engineering design project. In the School, there are a couple of projects, such as the PROMETHEUS project (electrical vehicle) and the design and construction of a wind turbine. However, these projects are not officially part of the School's curriculum. These projects could be used to showcase the outstanding quality of the graduates to industry, government and other stakeholders.

B. Teaching

APPROACH:

Does the Department have a defined pedagogic policy with regard to teaching approach and methodology?

Please comment on :

- Teaching methods used
- Teaching staff/ student ratio
- Teacher/student collaboration
- Adequacy of means and resources
- Use of information technologies
- Examination system

The pedagogical policy of the School is based on the combination of applied theoretical and technical education. It deploys a variety of teaching and learning methods including lectures, laboratory sessions, coursework and a mandatory diploma thesis and optional internships.

The School currently has 82 full-time faculty members, 89 administrative, technical and support staff (that is about to be reduced considerably) and close to 5,000 total number of undergraduate students with 3,008 considered by the School as active undergraduate students (UG). This is a huge number of UG students that results in approximately 1/36 faculty-to-student ratio, which is high. The technical support staff-to-student ratio is 1/214, which is also very high. It should be noted that these figures ignore postgraduate students.

Large classes are divided into smaller sections. It is not clear to the Committee how uniformity and consistency is enforced across the entire cohort of the students. There is anecdotal evidence that different lecturers set different standards and this creates difficulties for students, although apparently during the last years the School has made efforts to do away with such phenomena. The Committee encourages the School to make a concerted effort to ensure that examination standards are uniform as much as possible. It is also essential that the issue of examination results is planned at specific dates, which are transparent to students. Long delays are unacceptable.

On the limited evidence available to the Committee it appears that there is sufficient interaction between faculty members and students.

On presented evidence, educational resources (labs, lecture halls) are sufficient to deliver the curriculum. There is an increase in the number of members in each group conducting laboratory exercises that impacts the quality of learning of each student. Such increase is attributed to the large number of undergraduates and lack of sufficient technical support staff. A potential solution is to extend the access time to the labs, which will result in reduced numbers per group.

The Committee has no opinion about the capacity of the classrooms and associated equipment (LCD projectors, laptops, etc.) as it was unable to make an on-site visit. However, the Committee was informed that there is no lack of space or resources.

Library facilities at the School level seem to be sufficient. There were no complaints by faculty members or students, except that subscription to certain online libraries (i.e., IEEE Xplore) is not current due to budget cuts.

The use of information technology for teaching is solid.

The Committee also sampled a large number of high quality teaching material. The Committee commends the fact that 100% of the teaching material is online.

The School's annual undergraduate programme includes a 26-week teaching period (2 semesters x 13 weeks per semester) and a 12-week examination period (3 periods x 4 weeks per period). It is clear that the assessment annual period is about half of the teaching period,

which is extremely long. This, in conjunction with the policy allowing students to repeat exams without any upper limit, not only overloads the academic members of staff but is also detrimental to their research, to the students, other activities and to the educational process as a whole.

The examination of the undergraduate project work (Diploma Thesis) needs significant changes. All Diploma Theses have been marked with 10 out of 10 (outstanding mark). This implies that there is a serious problem with running and examining Diploma Theses and this has to be addressed by the School.

IMPLEMENTATION

Please comment on:

- Quality of teaching procedures
- Quality and adequacy of teaching materials and resources.
- Quality of course material. Is it brought up to date?
- Linking of research with teaching
- Mobility of academic staff and students
- Evaluation by the students of (a) the teaching and (b) the course content and study material/resources

From documents received and interviews with a sample of students the Committee understands that teaching procedures are solid and that teaching resources are more than adequate. However, students complained about the compression of the teaching periods due to strikes and occupations.

The Committee was impressed with the strong linking of undergraduate education and research. The Nationally Certified Research Lab structure encourages student participation in research.

The Committee observed that the overwhelming majority of upper level courses were research oriented preparing students for postgraduate work rather than addressing needs of the majority of students whose goal is to seek work in industry right after graduation.

The "Teacher Evaluation" procedure is carried out online. However, it is clear to the EEC that there is a low participation of undergraduate students (about 10%) in this evaluation process. It is recommended that the School devise a mechanism/strategy to maximize students' participation for all courses and that student evaluations should become a "metric" of the School's teaching performance.

RESULTS

Please comment on:

- Efficacy of teaching.
- Discrepancies in the success/failure percentage between courses and how they are justified.
- Differences between students in (a) the time to graduation, and (b) final degree grades.
- Whether the Department understands the reasons of such positive or negative results?

The large classes in some courses and laboratories – especially for the core courses, the repetitive strikes, the compression of semesters and the large number of examination periods impact the efficacy of the teaching and the School.

Furthermore, several students expressed the desire to have more exposure to the practical "engineering" part of their programme. They voiced the concern that the programme (but mainly the final year project, diploma thesis) is too heavily gravitating toward the "theoretical" aspects of the discipline.

The Committee asked the School to provide some recent statistics that were not included in its Internal Evaluation Report. Based on these statistics the average failure-rate of the students in many courses is very high, compared to the international norm. This is more

evident in the first 5 semesters. Considering the quality of the students, these failure rates are difficult to justify. The Committee's intention was to check several examination papers/questions including their corresponding model answers – and, thus, assess their quality, level and fairness. However, the strike did not allow this assessment.

IMPROVEMENT

- Does the Department propose methods and ways for improvement?
- What initiatives does it take in this direction?

The School is very dynamic; however, development appears to be somewhat “ad-hoc”. The strategic plan will help put structure to the future development of the School.

The Committee recommends that:

- More technical courses should be taught in the first year to stimulate engagement of the students and provide them with an understanding of what will be expected in subsequent years
- There should be more balance between synthesis/analysis in laboratories
- A group project should be added to the curriculum with clear aims and objectives and comprehensive marking criteria
- The examination questions should have graded difficulty so that the average student passes with an average mark and the excellent student is awarded with an excellent mark
- The marking criteria of the diploma thesis should be comprehensive and generally accepted.
- The State should limit the TOTAL number of students. In particular, there is a significant number of perpetually registered students that should be significantly reduced and finally eliminated

C. Research

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

APPROACH

- What is the Department's policy and main objective in research?
- Has the Department set internal standards for assessing research?

Overall, the School is very active in research at multiple levels: Competitively funded international projects involving collaborations with European partners; competitively funded national projects – although the funding level is reduced over the last years because of the financial situation in Greece, and, consulting services to the domestic public and private sector. To conduct research, the faculty members involve many times doctoral students, and postdoctoral researchers, and, sometimes, undergraduate students (mainly through diploma theses).

Most funding relates to European Union multi-University projects. This is a hard reality since domestic funding from several sources is limited. The main research leverage for the School comes through ICCS, which holds a distinguished position at both the national and European level as far as ICT competitive European projects are concerned. It was mentioned that this represents about 80% of the total annual turnover of ICCS. The research activity of ICCS is beneficial for the School as well as for NTUA as a whole.

The minimum duration of the PhD programme is 3 years (one intensive course-driven year, plus two research-based years). The PhD research students seem to be happy with the research infrastructure and the level of interaction with their PhD supervisors. However, the Committee thinks that the School should enhance the formal monitoring of their research progress through a semi-annual assessment process. Furthermore, the School has a “qualification” mechanism which is based on an intermediate assessment procedure that is

described in the postgraduate studies guide (see page 20). This “qualification” mechanism seems to be ad hoc and the students are assessed between 12 and 42 months after their initial registration. The Committee thinks that 42 months is too long for an “intermediate” assessment. A “qualification” mechanism before an examination committee earlier than the end of the 24th month can be a great motivation for students to establish their breadth of knowledge in the area of their research. This also helps for keeping only research students capable of obtaining a good quality PhD.

The School does not have internal standards for assessing research other than those built into the procedures of tenure and promotion of individual faculty members.

Overall, several faculty members have strong publication and citation records. It is emphasized that each team of the Nationally Certified Research Laboratories (Θεσμοθετημένα Ερευνητικά Εργαστήρια) have demonstrated awarded research and excellent funding record.

Collaboration with other international Universities is good. However, it is not clear to the Committee that internal collaboration within the School and University is as good as it could be. In addition, despite logistical difficulties, there must be stronger efforts to collaborate with industry and other key stakeholders.

IMPLEMENTATION

- How does the Department promote and support research?
- Quality and adequacy of research infrastructure and support.
- Scientific publications.
- Research projects.
- Research collaborations.

The School has a very solid research infrastructure thanks mainly to external funding and the individual efforts of the faculty, which facilitates research activities. This latter follows international practice.

The number of scientific publications is very good. Judging from the journals/transactions where they appear the quality is high. Furthermore, the School should be proud by some individual faculty member distinctions (e.g., IEEE Fellows).

The Committee encourages and supports faculty members to continue to be involved in IEEE and other professional society activities.

The number of research projects and the total external research funding is impressive. However, the School does not promote sufficiently its activities and achievements through publication of an annual/biannual report. The Committee strongly recommends that such a report be produced. It will enhance tremendously the international reputation of the School.

RESULTS

- How successfully were the Department’s research objectives implemented?
- Scientific publications.
- Research projects.
- Research collaborations.
- Efficacy of research work. Applied results. Patents etc.
- Is the Department’s research acknowledged and visible outside the Department?
Rewards and awards.

There is no official document that clearly states the School’s research objectives. Research projects offer a ‘mechanism’ to fund postgraduate students (who also act as teaching assistants in undergraduate courses).

Faculty members have publication records ranging from low to outstanding. Several faculty members are IEEE Fellows, Senior Members or have received research awards. They also serve in Editorial positions in acclaimed journals. It is important to state that several faculty members are well recognized as experts in their respective fields, internationally.

There is a very wide spectrum of funded research projects undertaken in the School. Research groups are actively involved in EU-funded projects, and every research group has had national funding over the last five years. Some research groups, through their respective research labs, provide certification (πιστοποίηση) services. The range of research activities is very impressive. On the other hand, it appears that there is no adequate collaboration among sections.

The doctoral programme is well established, with currently about 680-700 doctoral registered students, which is a very large number for the size of the School. The average duration of study is about 5 years, which is above international norms. It is not clear how many of the doctoral students are supported by funded research. Further, there is no uniform funding policy for doctoral students.

Some members of the Committee commend the highly specialised and in many cases unique research and other laboratory infrastructure facilities that many top schools would not have access to (in some cases, facilities are unique and world-class).

Although the committee had no access to the School's facilities since the evaluation was conducted outside the School premises, some members of the Committee are aware of the research facilities available to selected fields of research due to frequent visits and interactions with academic and research staff from these areas.

Overall, the faculty produces good research with pockets-of-excellence, collaborates internationally, and its publications are very well cited. Funding is sustainable and sufficient to support research activities. Performance is however uneven, the strategy is not clear and study times are very long thus perhaps explaining the not too high international School rankings.

Research funding: The amount of research funding is impressive. The Committee feels that the faculty must continue in this path. This will attract even better students and it will result in more publications and even more funding.

The ICCS is an excellent proven vehicle for research in the School, enhancing the research profile of the School.

IMPROVEMENT

- Improvements in research proposed by the Department, if necessary.
- Initiatives in this direction undertaken by the Department.

There is no specific plan to change research directions in the School. The research volume is impressive. However, the majority of competitive external funding comes from the European Union. This may cause difficulties in the future and the Committee recommends that the School seeks diversification in funding sources, e.g., industry based funding.

The Committee recommends the organisation of research days and seminars by the research leaders of the School to expose students to current research efforts of the School.

The training of postgraduate students in communication skills should be delivered in a better more coherent and organised way.

Some EEC members are perplexed about the usefulness/value of running two different doctoral degrees/programmes – taking into account that a “Doctor of Engineering” degree is considered in some countries as an industrial degree, i.e. more practical, less theoretical and less prestigious than a PhD degree.

D. All Other Services

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

APPROACH

- How does the Department view the various services provided to the members of the academic community (teaching staff, students).
- Does the Department have a policy to simplify administrative procedures? Are most procedures processed electronically?
- Does the Department have a policy to increase student presence on Campus?

The academic activities of the School are supported by 5 laboratory staff (ETEII) who deal with computing resources and laboratory operational issues, and 9 technical staff (EEΔIII).

The School has also 75 administrative staff members, who deal with various student affairs such as registration, finance and operational logistics, undergraduate and postgraduate studies, etc. The Committee members felt that this number is very high and they discussed this issue with the School. From these discussions it became clear to the Committee that a large number of the administrative staff members cover 'technical staff' needs. As such, it is recommended that a more balanced way is found to cover all School needs without adding to total staff members.

The School feels that services to students are generally good despite lack of sufficient technical support in laboratories. In general, the School considers that the provided services are of high quality.

The School is aware of the need to streamline administrative procedures. Anecdotal evidence from students indicates that further work is needed in this direction, e.g., in faster processing and release of marks, etc.

There is no policy to simplify administrative procedures. Although procedures are processed electronically, it appears that some procedures are still bureaucratic. The Committee was informed by students that although there is an ID card, in some cases, additional documentation or even 'additional' proof, are needed to complete administrative matters.

It appears that there is no centralized policy to increase student presence on campus. Due to the current uncertainty, students themselves seem to be eager to complete their studies on time.

There is no clear evidence that innovation is encouraged within the School at both undergraduate and postgraduate levels.

The ICCS is an additional complementary entity that supports and strengthens the School's activities. Its administrative services are streamlined and effective. Overall, the ICCS contributes to the betterment of the School.

IMPLEMENTATION

- Organization and infrastructure of the Department's administration (e.g. secretariat of the Department).
- Form and function of academic services and infrastructure for students (e.g. library, PCs and free internet access, student counseling, athletic-cultural activity etc.).

Due to the prolonged strike the Committee was unable:

- To talk to administrative staff and, therefore, it cannot comment with confidence on their experience.
- To visit NTUA and the School libraries. Nevertheless, the School had a presentation related to its library, which appears to offer good services. This positive view was also supported by the students. Some Committee members who have seen in previous visits the main library also commented that it is

excellent. It is important, however, to highlight that there is a current problem due to lack of access to the IEEE digital library and this is clearly serious. There are sufficient support resources (library, PCs, internet). However it appears that there are no formal student counseling services. The Committee does not have sufficient information to comment on athletic or other cultural activities.
RESULTS • Are administrative and other services adequate and functional? • How does the Department view the particular results? On the limited evidence available to the Committee, the administrative and other services appear to be functional. Due to historical reasons there is an imbalance between what are described as “administrative” and “technical” staff. This must be sorted out to reflect the true function of each member of staff. The Committee was informed that there is lack of support in some areas. In particular, the Committee was told explicitly that the technical support staff is inadequate to deliver the programme and curriculum needs of the School including equipment maintenance, and as such, postgraduate students are used as teaching assistance in the laboratories. The School is concerned with the potential reduction of the support and technical staff as it will not be able to complete all needed administrative services.
IMPROVEMENTS • Has the Department identified ways and methods to improve the services provided? • Initiatives undertaken in this direction. In the current climate it is difficult to engage in a rational discussion with staff under the threat of redundancies. Central funding and research funding provide some support but the current system appears to be inflexible in accommodating the developing needs in various areas of research, teaching and administrative support. This needs addressing at School/NTUA and Government level. A transparent structure reflecting the School’s real needs and practices may help keep the same level of administrative support or result in asking for additional funding. There is no plan at this stage to optimize services. Streamlined efficient administrative procedures are essential in the School.
Collaboration with social, cultural and production organizations
A section in the Internal Evaluation Report (Section 6, pp. 51-53) is dedicated to collaboration with social, cultural and production organizations. However, no additional comprehensive information was provided to the Committee regarding this subject.
<i>E. Strategic Planning, Perspectives for Improvement and Dealing with Potential Inhibiting Factors</i> <i>For each particular matter, please distinguish between under- and post-graduate levels, if necessary.</i>
Please, comment on the Department’s: 1. Potential inhibiting factors at State, Institutional and Departmental level, and proposals on ways to overcome them. 2. Short-, medium- and long-term goals. 3. Plan and actions for improvement by the Department/Academic Unit 4. Long-term actions proposed by the Department. The School is top-heavy in Full Professors. Out of the 82 currently active faculty members, 61

are at the level of Professor. The lack of junior and middle career level faculty members is obvious. Seven faculty members retired over the past 3-4 years. Vacant positions have not been filled. This is mostly attributed to the lack of replacement and new lines given to the Universities by the Ministry of Education.

The Committee feels that the current number of faculty members is sufficient, but the School should find a way to balance among the different faculty ranks in the future. Strategic areas should be chosen to reflect the School's future vision. This should be part of the School's strategic plan (that must be developed as soon as possible), which does not exist but it is needed.

It is clear to the Committee that the current financial situation in Greece and the complexity of the bureaucratic procedures of the Ministry of Education imposes additional obstacles to improving the School's infrastructure. Connection of the University with local industry is not overall satisfactory. Faculty members do want better collaboration with industry, but this may not be currently possible due to several reasons.

The Committee recognizes that the School is in transition due to the new law for higher education and also due to personnel and support staff renewal and succession.

In what follows, the Committee's observations are presented in terms of strengths, weaknesses, threats and opportunities. As a general comment the Committee expresses its concern for the perceived lack of cohesion within the School under the current uncertainties.

Strengths

1. The School attracts a large pool of the top tier of qualified students since it stands high on student preference.
2. Being one of the oldest Universities in the country, the School enjoys an outstanding reputation and an extremely successful record that has earned its prestige and respect in the international and national community.
3. The School has a number of very highly talented faculty members with remarkable achievements and international reputation.
4. The School is very well networked in the international community with many bilateral and multilateral agreements for collaborations.
5. The overall academic programme has extensive coverage of a wide spectrum of subjects in the fields of electrical and computer engineering.
6. The quality of the interdepartmental, postgraduate programmes in which the School participates seems to be high.
7. Graduates from the School are highly praised by international universities where they continue postgraduate studies.
8. International research based recognition is good (however, the international rank in both QS and Times Higher Education rankings is lower than one would expect).
9. External funding is impressive despite financial challenges in Greece.
10. The ICCS is essential and a highly valuable complement that promotes and supports research.
11. The infrastructure facilities seem to be more than sufficient and some Committee-members consider them impressive. This is attributed mainly to competitive external funding.

Weaknesses

1. The number of students is very large. It results in high student-to-faculty ratio, and low support staff-to-student ratio.
2. There seems to be a culture of complacency between students that extends studies beyond five years, and thus wasting resources.
3. The number of required undergraduate courses (including the mandatory and elective ones) is excessive. It places a heavy load on the students and may be one of the factors contributing to longer time needed to complete the programme of studies.
4. There is no properly enforced prerequisite structure on all taught courses.
5. There seems to be evidence of numerous retakes of examinations of the same course until a passing grade is received. The number of retakes is not recorded in the

academic transcript. The lack of penalties encourages the prolongation of studies and waste of resources. Such practice increases the cost of educating the students unnecessarily.

6. Fundamental courses and upper level courses are disconnected. It would be beneficial for students to understand the importance of fundamental courses and how they connect to their studies/degree.
7. There is no academic advisor or mentor. Incoming students seem to be lost about what the School is all about.
8. The importance of the concept of 'deadline' is not recognized.
9. The marking of the diploma thesis is done without well understood and followed criteria. It is clear that the range of markings is severely biased towards the top mark, thus, conveying very limited information. The School should seriously consider the objectives of the project (educational or research) and follow a truncated normal distribution of marks.
10. Some of the courses have high failure rates. The School should introduce an internal quality assurance mechanism, to ensure that the examination questions are fair, of the right standard and can be successfully answered within the allocated time.
11. There is a significant number of registered perpetual students. This has a negative impact on teaching, assessment process and the logistical organisation of the School. While this is an issue affecting higher education students across the sector in Greece, the School should be pro-active to mitigate its effects on the system.
12. There is no consistent funding mechanism to support postgraduate students and their research. There is limited funding to support PhD studies. The School should develop procedures to provide some support to PhD students in the form of scholarships, for instance, by making use of fundraising opportunities with alumni and industry.
13. There are no formal procedures to support the training of PhD research students. The School should introduce a structured programme to assist students in the development of their research skills, scientific writing and presentation skills. In addition, quality control procedures to detect issues related to the achievement of their research goals should be assessed on an annual basis – enhancing the current "intermediate evaluation".
14. There is a lack of knowledge transfer activities at the School level (patents, spin-offs, etc.).
15. The School needs to establish a forward-looking vision in terms of its position on the international arena. Its vision statement should be backed up by specific objectives in terms of its core processes of teaching, research and knowledge transfer. These objectives should be quantified in terms of Key Performance Indicators on a yearly basis, to provide feedback in terms of the efficiency of the processes.
16. The state imposed bureaucratic systems have stifling effects on the development of the School. They result in indecisiveness and ineffectiveness.
17. There have been no new hires in the faculty. The majority of the academic staff members are seniors (full Professors) which demonstrates lack of proper recruitment policy. The lack of renewal may have negative impact on the School's programmes in the future.
18. There is no cohesive strategic plan for the School. There is no set of quantitative measures, concrete goals and milestones, e.g., quality assurance mechanisms and regular evaluations of individuals and procedures.
19. Annual personal review, development and feedback mechanisms for faculty members and other staff could be considered by the School and the University. This is important for all staff in order to retain and motivate them and improve efficiency.
20. There is no automation of student-facing processes (e.g., marking and transcripts) within the School. Automation will contribute to increasing the quality and efficiency of student services.
21. There is very limited interaction with Alumni. The School should increase its interaction with Alumni in order to create further training and funding opportunities for its students and recent graduates.

Threats

1. The continuous disruptive activism of 'some groups' and the State's interference in higher education threatens and stifles productive initiatives in the School and

- provide unnecessary obstacles to the School's advancement.
2. The Committee is concerned by the lack of cohesion amongst the faculty members. Although there are plans within each section, there is no strategic plan that encompasses the School as a whole.
 3. The current framework of decision making within the School is too cumbersome for managing changes.

Opportunities

1. The proliferating numbers of talented and successful graduates of the School can be a major resource of support at all levels. For example, it can be exploited through tracking and engagement and increased linkage.
2. The Committee understands that there are opportunities to develop internal organizational plans, which can be exploited to accomplish worthy goals and objectives that the previous operational framework did not allow.

F. Final Conclusions and recommendations of the EEC

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

Conclusions and recommendations of the EEC on:

- the development of the Department to this date and its present situation, including explicit comments on good practices and weaknesses identified through the External Evaluation process and recommendations for improvement
- the Department's readiness and capability to change/improve
- The Department's quality assurance.

In order for the School to fully achieve its objectives it is necessary to have more flexibility in its operational and planning framework, which relates directly to staff recruitment, student numbers, facilities and services. The Committee presented in Sections A to D of this report its main findings on the curriculum, teaching and research activities as well as on the various School services. The main observations and conclusions of the Committee were then grouped in Section E in terms of strengths, weaknesses, opportunities and threats.

In this final section the Committee summarizes its main conclusions/findings in the form of the following recommendations to the School:

1. A modern, tractable and regularly updated strategic plan should be developed with specific goals, milestones, quantitative measures, and evaluation procedures that must be a living document to guide the School's activities.
2. The curriculum should be thoroughly revised towards a more modern structure with tracks of prerequisites towards diverse specializations, and a reduced load with an eye towards keeping up with advances in the specialization areas.
3. The number of courses for obtaining the degree should be reduced considerably as previously discussed.
4. The governance rules of the School may have to be modified, to the extent possible, so as to assign some real executive power and increased responsibilities to the Dean/Department Head to increase the effectiveness in the implementation of change and new initiatives.
5. The students should have a course personal advisor who monitors and manages their progress - particularly during the first two years of study.
6. The School should consider increasing the number of international students taking courses at NTUA. In this context, the School may consider teaching some postgraduate courses in English.
7. The Committee feels that 12 weeks of exam period per year is excessive and counterproductive. This should be corrected.
8. The School should introduce an annual Research Day as part of student orientation where laboratories are open. Short presentations should be given.
9. The School should set reasonable deadlines for coursework and diploma thesis submission (with penalties for late completion), which are respected and enforced. It

should be noted that the ability to follow deadlines is an essential attribute of every competent engineer.

The Committee sincerely thanks the School for its collaboration during the week of the visit in spite the difficult circumstances.