



ΕΛΛΗΝΙΚΗ ΔΗΜΟΚΡΑΤΙΑ

HELLENIC REPUBLIC

**Α.ΔΙ.Π.**

**H.Q.A.A.**

ΑΡΧΗ ΔΙΑΣΦΑΛΙΣΗΣ ΠΟΙΟΤΗΤΑΣ

HELLENIC QUALITY ASSURANCE AGENCY

ΑΝΩΤΑΤΗΣ ΕΚΠΑΙΔΕΥΣΗΣ

FOR HIGHER EDUCATION

## **EXTERNAL EVALUATION REPORT**

DEPARTMENT Medical Instruments Technology (TIO)

TEI of Athens

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### **External Evaluation Committee**

The Committee responsible for the External Evaluation of the Department Medical Instruments Technology of the Technical Institution of Athens consisted of the following four (4) expert evaluators drawn from the Registry constituted by the HQAA in accordance with Law 3374/2005 :

- 1. Dr. Elias Siores** (President)  
University of Bolton, Bolton, United Kingdom
  
- 2. Dr. Arion Chatziioannou**  
UCLA Jonsson Comprehensive Cancer Center, Los Angeles, U.S.A.
  
- 3. Dr. Lefteris Livieratos**  
King's College London, United Kingdom
  
- 4. Dr. Dimitrios Spigos**  
The Ohio State University, Columbus, Ohio, U.S.A.

**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***

### I. The External Evaluation Procedure

- Dates and brief account of the site visit.

Monday, October 1<sup>st</sup>, 2011 – Wednesday November 2<sup>nd</sup>, 2011

- Whom did the Committee meet ?

Met with TEI President, Dean of School, Dept. Chair, faculty, students, administrative staff and alumni.

- List of Reports, documents, other data examined by the Committee.
- Groups of teaching and administrative staff and students interviewed
- Facilities visited by the External Evaluation Committee.

### II. The Internal Evaluation Procedure

Please comment on:

- Appropriateness of sources and documentation used
- Quality and completeness of evidence reviewed and provided
- To what extent have the objectives of the internal evaluation process been met by the Department?

### **I. The External Evaluation Procedure**

\* **Whom did the Committee meet?**

**Dates of the site visit:**

Monday, October 31<sup>st</sup>, 2011 – Wednesday, November 2<sup>nd</sup>, 2011.

**Brief account of the site visit:**

The visit consisted of 3 main parts:

Firstly, the Committee met with the President and Vice President, Prof. D. Ninos and Prof. I. Chalaris, respectively, of the Technological Educational Foundation (T.E.I.) of Athens as well as with the Director (Dean) of the Faculty of Technological Applications (Prof. D. Triantis).

Secondly, the Committee visited the premises of the Department. This was the main part of the visit, starting with a series of visual oral presentations given by members of teaching personnel (Prof. I. Kandarakis, Prof. D. Cavouras, Prof. E. Ventouras, G. Loudos, Ass. Prof, D. Glotsos, Lecturer), who described the activities of the Department. The presentations concerned a general introduction and description of the Department, the internal evaluation procedure of the Department and the research and the international co-operation activities of the Department. Then a visit to the various educational and research laboratories of the

Department took place, comprising a brief oral exposition of the activities of each laboratory by the personnel involved in the activities of the laboratory, as well as a visit to the Secretariat of the Department. Then a separate meeting took place between the Committee members and Professors of the Department. There was also a visit to the general infrastructures provided by T.E.I. of Athens, such as the library, the computer network centre and the teleconference centre. Afterwards, a meeting with students took place, without the presence of teaching staff. Then a meeting took place with the majority of the teaching staff, including both permanent and non-permanent staff (i.e., laboratory teaching instructors and post-doctoral researchers). Finally, a meeting with alumni of the Department took place, during which again the teaching staff of the Department was not present, except for non-permanent staff who are also members of the alumni of the Department.

Thirdly, a visit took place to a research laboratory (used also for educational visits) of the Department, which is housed in a location external to the T.E.I. of Athens, at the "Democritus" Research Centre. The laboratory has been established in the framework of a continuing formal cooperation between the Department and the Research Center.

\* **Whom did the Committee meet?**

The persons that the Committee met are presented below, according to the date of each meeting:

Monday, October 31st

The Committee met with:

- The President and the Vice-President of the TEI of Athens (Prof. D. Ninos and Prof. I. Chalaris, respectively),
- The Director (Dean) of the Faculty of Technological Applications (Prof. D. Triantis).
- The teaching staff (including both permanent personnel and collaborators) during a meeting with oral-visual presentations as follows:
  - I. Kandarakis, Professor: "Introduction-Presentation of the Department".
  - D. Cavouras, Professor, "The Internal Evaluation Procedure".
  - E. Ventouras, Professor: "Research Activities of the Department".
  - G. Loudos and D. Glotsos, Assistant Prof. and Lecturer, respectively: "Co operations of the Department at international level".

Tuesday, November 1st

The Committee met with:

- D. Vattis (Professor) and C. Fountzoula (Assistant Professor), from the Department of Physics, Chemistry and Materials Technology, at the premises of the Biomedical Engineering II Laboratory.
- E. Ventouras (Professor) and M. Kallergi (Associate Professor), at the premises of the Biomedical Engineering I Laboratory.
- G. Loudos (Assistant Professor), at the premises of the Medical Instrumentation Laboratory.
- I. Valais, (Assistant Professor), at the premises of the Availability, Maintenance and Servicing of Biomedical Equipment Laboratory.
- D. Cavouras (Professor), D. Glotsos (Applications Professor), P. Asvestas (Applications Professor) and I. Kalatzis (Applications Professor), at the premises of the Medical Image and Signal Processing Laboratory.
- V. Spyropoulos (Professor), A. Tzavaras (Special Technical Personel) , at the premises of the Biomedical Engineering III Laboratory.
- I. Kandarakis (Professor), N. Kalyvas (Applications Professor), P. Liaparinos (Applications Professor elect) and S. David (Laboratory teaching collaborator and post-doctoral researcher) , at the premises of the Ionizing and Non- Ionizing Radiation Imaging Systems Laboratory.
- The Head of the Secretariat of the Department, Mrs. P.Thiakou and the Secretary Assistant Mrs. Kokinea, at the premises of the Secretariat of the Department.
- Separate discussions took place between the Committee members and Professors of the Department in the Departments' Head bureau. The Committee met with Professor E.

Ventouras, Professor V. Spyropoulos and Assistant Professor G. Fountos.

Wednesday, November, 2nd

The Committee met with:

Professor G.Loudos and post-doctoral researchers of the Department, at the premises of the Experimental small animal imaging, PET & SPECT Systems Laboratory of the Department, housed in the "Democritus" Research Centre.

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

The Committee examined

- The Syllabus of the Department,
- The internal Evaluation Report, prepared by the Department's Internal Evaluation Committee following the guidelines of the H.Q.A.A.
- Samples of examination papers evaluated by the teaching personnel
- Samples of laboratory exercises reports
- Samples of textbooks and lecture notes used for educational purposes
- Samples of Final Year Project Reports, Postgraduate and Doctorate theses
- Samples of Scientific Publications in Scientific Journals and Conference Proceedings
- The web site of the Department was presented to the Committee (including the e-class platform, the administration support platform, course syllabus, CVs of the teaching personnel, Description of Research Projects and activities etc)

\* **Groups of teaching and administrative staff and students interviewed:**

As mentioned above, the Committee met with the teaching staff (both permanent personnel and collaborators) of the Department as follows: (i) during the first day meeting (with general presentations of the activities of the Department), (ii) during the visits to particular laboratories, at the premises of the laboratories, (iii) during the interviews with personnel, as well as with the two members of the administration staff (Secretariat) of the Department. The Committee had also: (i) a general meeting with the majority of the teaching staff, (ii) a meeting with students, without the presence of teaching staff, as well as a meeting with alumni of the Department.

\* **Facilities visited by the External Evaluation Committee.**

As mentioned above the Committee visited the following facilities:

Laboratories: Biomedical Engineering I,II & III, Medical Instrumentation, Availability, Maintenance and Servicing of Biomedical Equipment, Medical Image and Signal Processing, Ionizing and Non- Ionizing Radiation Imaging Systems and the Experimental small animal imaging, PET & SPECT Systems Laboratory of the Department.

Offices: Secretariat Office, Head of the Department's Office.

Infrastructure facilities: library, computer network centre and the teleconference centre.

## **II. The Internal Evaluation Procedure**

### **\* Appropriateness of sources and documentation used**

The sources and the documentation used covered adequately all educational and research activities of the Department, giving appropriate descriptions and corresponding data. The web-site of the Department was particularly helpful, incorporating useful information on most of the material related to the activities of the Department, such as the Syllabus, with a detailed description of the material taught and the scope and objectives of each subject matter/course, the personnel CVs with most of their publications in scientific journals and conferences, the description of the research activities of the laboratories etc.

### **\* Quality and completeness of evidence reviewed and provided**

The evidence provided to the Committee and reviewed was at a satisfactory level concerning quality and completeness, since it enabled, to a significant extent, to corroborate the sources and the documentation that was available. This concerned

- laboratory exercises completed by the students,
- Examples of examination papers
- Samples of theses (both undergraduate and postgraduate) and Ph.D. Theses

### **\* To what extent have the objectives of the internal evaluation process been met by the Department?**

The objectives of the internal evaluation report were to document the Department's achievements regarding educational, administrative, and research tasks and to identify points needing improvement.

Regarding the Department's educational achievements, evidence has been provided concerning a) the recently adopted syllabus taught in the 8 semesters course, related to other Biomedical Engineering courses in European Universities, b) the equipment employed in the laboratory work followed by the students, c) the assistive educational services available to students such as e-class, web-site, books and notes, d) of the advertisement of the Department and its achievements in national and international exhibitions, e) the recruitment in the last five years of young scientists as instructors, with intense research profile and f) the post-graduate and doctoral courses in which the Department is involved. Weaknesses have been pointed out regarding delays in student graduation, low graduation grades, increases needed in the number of available lecture rooms and laboratories and low student attendance in theoretical subjects. In some of the points that were raised, however, no conclusive proposals were given, such as how to improve success rates in the first year students or how to improve student attendance.

Regarding the administrative part of the report, evidence of the infrastructure regarding library, healthcare, teleconferencing, internet, and secretarial work were provided.

Regarding research, evidence of national and international funded research projects coordinated by or with participation of members of the department were presented, research profiles of members of the Department have been documented, and suggestions as to the continuation and improvement of research activity have been presented. However, no Departmental policy regarding research was witnessed, or was suggested to be adopted in the future, and the suggestions for the to the continuation and improvement of research activity included mainly relying on the existing research strategy model, i.e., that of few individual research teams conducting their research, with only source of possible income funds those that can be acquired from European or national research grants and the equipment budget of the T.E.I. of Athens.

## **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?

The goals and objectives of the Department are clearly set out in the internal evaluation report. The Department aims to provide a complete and coherent educational program in the field of biomedical technology and instrumentation and to promote research and development in the field. The Department is unique in the country in offering a course in the field of biomedical technology and instrumentation.

The educational activities of the Department include the undergraduate program, teaching contributions to two structured post-graduate programs (MSc level) and co-supervision of Doctorate (PhD) projects.

#### Undergraduate program:

The main scope of the undergraduate program is to provide higher education and training for students in biomedical technology and instrumentation aiming at fulfilling employment needs in this highly specialised and multi-disciplinary field in the public and private sector (e.g. hospitals, medical instruments manufacturing and support, applications and sales specialists etc). A number of graduates may continue with further studies at postgraduate level. The committee feels that the goals of the school are achieved by the curriculum at very high standards.

A high level of interaction of the Department with the industry (hospitals and companies active in the field) as well as with national and international academic groups (through teaching and research collaborations) has assisted the update of the curriculum to current high standards and should continue to do so. The recent review process, based on a questionnaire addressed to students and members of staff during the academic period of 2009-2010, contributes further to the process of continuous curriculum assessment and development; Adopting such practices on regular basis is highly encouraged.

Graduates of the course present outstandingly high rates of employment (based on statistical data collected up to 2008, an alumni service pivotal for the long-term success of the course). This is an encouraging sign of the overall success of the course in fulfilling its educational objectives and serving the society.

#### Postgraduate program:

The Department contributes with teaching to two structured postgraduate programs (MSc):  
 - The postgraduate program in “Information Technology in Medicine and Biology” of the National and Kapodistrian University of Athens, in cooperation with the Technological

Educational Institute (TEI) of Athens, and in collaboration with the Foundation for Biomedical Research of the Academy of Athens (BRFAA) and the Institute of Informatics and Telecommunications of the National Centre for Scientific Research "Demokritos".

- The postgraduate program in "Medical Physics" of University of Patras.

Staff members contribute substantially with teaching to the above courses. These activities promote strong links with other academic institutions active in the field, contribute to the continuing development of teaching and supervisory skills of staff and constitute a considerable educational asset of the Department for future development of postgraduate programs.

Doctorate program:

Although there is no provision for an official PhD program under the current regulatory framework for TEI, several faculty members of the Department are active in the co-supervision of PhD students in collaboration with external academic institutions. This further enhances academic and research links and promotes the staff development as well as informing the standard curriculum with current developments in the field.

#### 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 staff to implement the curriculum?

The curriculum is generally well structured from core modules (such as Physics and Mathematics) during the early semesters to more specialised ones focusing on the applications serving the scope of the course. A combination of theoretical and lab-based modules delivers a well rounded educational program of high standards.

Laboratory facilities are generally of very good standards though space appears restricted considering the full number of students admitted. Lab equipment is generally of good standards though some applications seem to be poorly represented (e.g. laser or ultrasound). Course material is provided in the form of impressively extensive electronic course resources (e-class) along with course textbooks offered under the Eudoxus platform.

Recent amendment of the curriculum according to the new study structure at TEI had minimal impact to the course content. However, as modules are now offered at annual basis (rather than per semester) and in conjunction with regulation for pre-requisite modules, this may have an impact in average study completion length. Streamlining or interleaving pre-requisite modules may be an alternative option to avoid prolonging graduation unnecessarily.

In the final semester, trainee placements in a real-life working environment are invaluable in this technology-oriented field. The final year project is a good opportunity to conduct self-assist in-depth development of a topic. It was not clear if oral presentation and peer-review (amongst fellow students and staff) is mandatory though in any case, this should be highly

encouraged.

The appointment of ex-graduates of the Department should be discouraged since this may carry the risk of limiting the influence from a wider spectrum of expertise in this fast growing field of biomedical applications.

A considerable part of the teaching program relies on external short-term hourly-paid staff (mainly scientific laboratory associates) which may pose a considerable liability under current financial and strategic policies external to the department. However, further exploiting links within the Faculty of Technological Applications and across the TEI, such as with the Department of Radiography, may offer additional support.

The committee feels that engagement of the industry (companies active in the field, hospitals, ex-graduates, potential employers etc) is pivotal both for curriculum development and the professional orientation of students. This has been in place over the years, in the form of informal links to facilitate trainee placements in companies and hospitals. More recently, the collection of data for the evaluation of student trainee placements has started in a more systematic manner. Further and systematic development of these links and increased involvement of the industry and alumni in curriculum development would be strongly recommended.

## 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?

The success of the undergraduate curriculum is supported by the high level of employment of graduates as well as the considerable number of them (approximately 10%) continuing with postgraduate studies within and beyond the Department.

Mandatory attendance to lab-based modules (typically, at least a 12 out of 13 week attendance is required) ensures a successful incentive for student progress. However, lack of attendance requirements (under general TEI regulations) for theoretical modules appears to be an impediment to students with implications also to efficient understanding of laboratory work. Possible solutions may include extending mandatory attendance to theoretical modules or introducing partial assessment in the form of essays throughout each semester, though implementation may be confined by general institutional regulations across the TEI.

An additional impediment is the varied academic level of first year students, including those admitted through the regular national examination process or additional routes of entry. The varied degree of background education in core topics such as Physics and Mathematics may pose difficulties to assimilation and progression of students, potentially resulting in passive drop-out (i.e. registered students who do not attend). This is a general issue for higher education that the Department is aware of and eager to address though possible resolutions may not be obvious or straightforward. The introduction of additional teaching aids, for example in the form of tutorials and small study groups, may be largely incompatible with current culture of academic practice in Greece but in general is an invaluable tool used by international academic institutions.

In addition, the core syllabus of the first year, although fully justified and necessary, may initially alienate students entering a biomedical technology course. The need of such core syllabus is clear in later years and students at 2<sup>nd</sup> and 3<sup>rd</sup> years seem to find it beneficial for understanding more specialised context as the course evolves. An early introduction to biomedical technology applications which would obviate the utility of core subjects, may be desirable.

#### IMPROVEMENT

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

Despite a successful undergraduate curriculum over a number of years demonstrated by high graduate employment rates, some areas of improvement may include the following:

Increasing attendance across modules, especially in theoretical subjects, should be beneficial for students.

The introduction of additional teaching aids such as tutorials and small study groups, should be reconsidered.

Early introduction to biomedical technology applications along core subjects in first year would engage students to help their progression through to more specialised subjects in subsequent years.

Further and systematic development of links with the industry, government organizations and alumni in curriculum development should be encouraged. Links with alumni and collection of graduate employment data should be continue to be developed.

Maintaining and developing educational and research collaborations enables continuous curriculum development in par with current practices and applications.

Revisiting on regular basis the reviewing process started with the questionnaire of 2009-2010 would consist a good practice of continuous curriculum development and improvement.

The Department is aware of the above issues and appears fully committed and interested in continuous improvement.

## ***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

Teaching is provided in lecture halls and in laboratories. The conventional lectures are given by the professors in three classrooms where oral presentations are supplemented with writing on chalkboard; a time honored method used in primary and secondary education as well as in higher education. The attendance is on a voluntary basis and the attendance is poor. A more intense form of learning is provided in the laboratories. Although these sessions are supposed to be used for practical applications, professors take advantage of the near universal attendance to supplement and fill voids in their students' knowledge by focusing and spending additional time on one to one basis with individual students to facilitate their understanding of the topic. Thus the didactic approaches vary from conventional to highly interactive.

The comments provided by the students regarding teaching were positive. It is generally agreed by professors and students alike that poor results in the first two semesters is due to lack of student's attendance, while there is a significant improvement in students participation and engagement in their senior years due to the fact the courses become more relevant to the students interest and also more focused to the mission of the department to teach and conduct research in the field of medical instrumentation. The need to employ more gifted teachers in the early years or to introduce a course that explains and amplifies the relevance of the courses given to the first year students to fields thought in later years, is highly recommended.

The department is staffed by 16 regular professors and 11 hourly paid professors. The ratio of professors to 800 students appears appropriate given that approximately only 400 students are active at any given time. Mutual respect and cooperation exists between active students and their professors a fact that was repeated in our meeting with former students (alumni) some of whom had graduated a long time ago while others were recent graduates.

Lecture room space and in some occasions lab space appears to be limited and it would require re-evaluation should the student attendance patterns change as a result of changes in current regulations.

Supplementation of the course material in the form of impressively extensive electronic course resources (e-class) is a very positive use of information technology along with course textbooks offered under the Eudoxus platform.

The current examination approach is based on written exams given at the end of semester and the completion of laboratory exercises. This approach could be amplified by the introduction of midterm credit bearing exams. This internationally accepted practice will

enhance the learning process throughout the semester.

Areas of improvement can be made by linking research with teaching and also by having professor's textbooks in the TEI library to be used within the library, especially if the time the library is open is extended into the evening.

In summary, the level and quality of teaching are considered to be high. The same is true for the course material. The lack of attendance in the first year can be improved only if the students' culture changes or the educational system requires such attendance necessary in order to obtain the expected credit. The new legislation will force students to take their studies seriously and complete them within the four years of study but no later than six years. The department has already implemented learning improvements by providing extensive material on the web. The EEC suggested a program of visiting professors either from industry or academia. The EEC suggested that each student should have a professor as an advisor who will help them navigate difficulties either with learning and/or life at large.

#### 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

In general, the level and quality of teaching are considered to be high. The same is true for the course material. The lack of attendance in the first year can be improved only if the students' culture changes or the educational system requires such attendance necessary in order to obtain the expected credit. The new legislation will force students to take their studies seriously and complete them within the four years of study but no later than six years. The department has already implemented learning improvements by providing extensive material on the web.

Mobility of academic staff and students within the country is relatively good with increased interaction with other higher education institutions through teaching contributions to other courses and research collaborations. This aids continuing professional development and networking. However, international mobility appears rather restricted despite the necessary framework being available (provision for Erasmus and collaboration agreements with other universities) and should be encouraged in order to further development of international links in the current climate of open global competitiveness. The EEC suggested a program of visiting professors either from industry or academia.

Questionnaire based evaluation by students was recently introduced as part of the department's evaluation process; its regular approach may be a helpful aid in the process of continuing improvement. Comments provided by the students throughout the visit of the EEC, regarding teaching were positive.

#### 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?

Efficacy of teaching is considered to be high. Discrepancies exist in success rates between early and late semesters: Poor results in the first two semesters may be attributed to lack of student's attendance, while there is a significant improvement in students participation and engagement in their senior years due to the fact the courses become more relevant to the students interest and also more focused to the mission of the department to teach and conduct research in the field of medical instrumentation. The need to intensify teaching efficacy in the early semesters or to introduce a course that explains and amplifies the relevance of the courses given to the first year students to fields thought in later years, are highly recommended. Discrepancies in success rates between courses also exist and the department should continue to closely monitor these in order to understand the route causes of any incongruent patterns. The department has evaluated such patterns in the past and taken steps in the right direction in understanding exceptionally low success rates in some courses.

#### IMPROVEMENT

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

In summary, the level and quality of teaching are considered to be high. The same is true for the course material. The lack of attendance in the first year can be improved if the students' culture changes or the educational system requires such attendance necessary in order to obtain the expected credit. The new legislation will force students to take their studies seriously and complete them within the four years of study but no later than six years. Another helpful approach would be the introduction of mid-stream examinations, and possibly homework that would count towards class grade, strengthening the learning process throughout the semester. Re-evaluation of the available facilities (lecture room space and in some occasions lab space) would be required should the student attendance patterns change. The department is aware of such issues and has proposed improvements long this direction.

The department has already implemented learning improvements by providing extensive material on the web. The EEC suggested a program of visiting professors either from industry or academia. The EEC suggested that each student should have a professor as an advisor who will help them navigate difficulties either with learning and/or life at large.

## **C. Research**

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

### **APPROACH**

- What is the Department's policy and main objective in research?

The main objective of the TIO Department is technical undergraduate education towards training a cadre of BS level graduates, typically absorbed by companies engaged in maintaining, servicing and selling medical instrumentation in Greece. In addition to this key goal, and even though not strictly permitted by its organizational charter, TIO has developed a successful research program, spearheaded by energetic faculty in four laboratories who collaborate with faculty at other Universities in Greece, that grant graduate degrees, at the Masters of Science (MS) and Doctor of Philosophy (PhD) levels.

While there is a committee composed by regular faculty, whose main objective is coordination of research and the generation of a strategic plan, an overall plan for research is not clearly communicated in a mission statement. The development of such a statement could be helpful in the consolidation of ideas. It was evident during this review that while there is an emphasis on imaging related research, this is due to the strength of the faculty engaged in these research fields, which are encouraged to pursue these endeavors.

- Has the Department set internal standards for assessing research?

The internal standards for assessing research are no different than the international norm, which involves (i) publication record in peer reviewed journals with impact factors, (ii) calculations of citation indices excluding self citations and (iii) success in securing extramural funding. While adhering to these standards is expected, the successes they achieved in all these areas should certainly be commended.

### **IMPLEMENTATION**

- How does the Department promote and support research?

Research is promoted by the Department indirectly, in the sense that achieving national and more importantly international recognition by the scientific community peers leads to career advancement. Additionally, successful applications for independent research funding from national and international programs lead to further faculty independence in attracting high caliber graduate students and post-docs who can further increase the success of research. A strong publication record and presence to international conferences further accelerates this mechanism.

- Quality and adequacy of research infrastructure and support.

There are some limitations regarding the research infrastructure, mainly with respect to the available space. These limitations are not unique to TIO, and need to be viewed under the prism of budgetary realities. Despite that, these space limitations do appear to be very striking, especially with respect to the space allocated for the research collaboration at one site that the review committee visited. Regarding the instrumentation infrastructure available for research, TIO has been quite successful in securing a commendable variety of research equipment, (for example an x-ray microCT system) again closer linked to the laboratories that have been successful in securing research funding. Continued success of TIO, requires the expansion of their equipment and facilities in other application areas such as ultrasound, lasers, as well as discipline areas such as dental, ophthalmology, physiotherapy etc.

- Scientific publications.

Faculty, graduate students and research staff are well aware of the importance of peer reviewed publications. Characteristically, the separately listed category of non-peer reviewed publications was essentially empty in their evaluation records.

- Research projects.

Faculty and staff are actively seeking external funding for research projects, and have been quite successful in securing extramural grants both from Greece and foreign sources.

- Research collaborations.

There is significant evidence of both national and international level collaborations, with participation in bilateral and multilateral research.

## RESULTS

- How successfully were the Department's research objectives implemented?

Despite the fact that there was no clearly stated mission statement, which makes difficult to assess whether a particular goal was met, there was a consensus agreement among the review committee that quality of research was on a high level.

- Scientific publications.

The refereed scientific publications are of good caliber and in the directly relevant international instrumentation technology journals. While on average, the number of these publications is not high (for the number of faculty of TIO), accounting for the fact that the majority of publications come from the labs involved in research, the number of publications is competitive at an international level, something quite commendable for a mainly teaching institute.

- Research projects.

The research projects are mostly imaging related, indicating a somewhat narrower spectrum, with respect to the large diversity of areas that are taught in the training program. This is something expected from the number of active researchers in the Department. The research projects are current and competitive at the international level, as witnessed by the publication record as well as by the international funding sources.

- Research collaborations.

The research collaborations are appropriate and bring complementary knowledge and infrastructure to the research projects, in many ways unavailable elsewhere in Greece. By the same token, TIO is also unique in Greece as are the services it provides. The collaborations extend beyond the national boundaries, into the EU and global level.

- Efficacy of research work. Applied results. Patents etc.

The applied science nature of the research, produces results that can be directly applied to projects in collaboration with other disciplines. Examples are their closely linked work with Dimokritos, where the instruments they develop are used for preclinical research.

It is quite surprising that there appears to be no institutional policy on patents, while the faculty is completely unaware of the process related to patent application, intellectual property rights and product commercialization. It is naturally expected from faculty in a technical department to be well versed in both the academic and practical details of intellectual property pursuits.

- Is the Department's research acknowledged and visible outside the Department?  
Rewards and awards.

Research outcomes are visible at the national and international level as evident by journal publications and external funding. This success is concentrated in a few select topics.

**IMPROVEMENT**

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

Target new faculty hires towards diversifying the research program to include research in areas other than radiological imaging.

Possibility to help with administrative support in grant submission (budgeting, formatting, progress report preparation etc). Should success in securing research funds continue as it has in recent years, consideration should be given for a portion of returned overhead to enter a research lab as discretionary funding for research purposes.

It is recommended that TIO establishes awards for best paper, best thesis, best dissertation, and other awards, like travel awards etc., which should stimulate competition and excitement among students.

The Department needs to focus and continue the pursuit of external funding for research, especially in the light of ever decreasing government funds available.

## **D. All Other Services**

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

### **APPROACH**

- How does the Department view the various services provided to the members of the academic community (teaching staff, students).

TIO is well organized at both UG and PG levels. There is a clear focus on students and all services provided are directed towards ease of access to all facilities including teaching classrooms, host and shared laboratories etc. Teaching staff are provided with basic services that can be improved. For example office space is limited for all staff and PG research student accommodation is cramped. Some laboratories are clustered with equipment and this may create health and safety issues as new technologies are being incorporated and more are expected to be included in the curriculum. Despite the fact that overall the departmental facilities are spread over different sites in TEI, there is cohesion and above all collegiate atmosphere.

- Does the Department have a policy to simplify administrative procedures? Are most procedures processed electronically?

Administrative procedures have been simplified over the years and recently they are aided substantially by IT systems. Most administration activities are processed electronically and kept centrally with appropriate systems in place to assure that confidentiality is kept and security is safeguarded.

- Does the Department have a policy to increase student presence on Campus?

TIO is planning expansion in both UG and PG offerings. Such developments will increase the number of students and possibly the number of staff (academic, administration and technical support). However, if synergies in future offerings, amongst inter and intra school collaborations / amalgamations, are suitably explored, developed appropriately and established in a timely manner, both issues of scale and scope can be achieved for the benefit of students, industry and society at large. Increasing the number of students must be preceded by expansive activities in the private and government sectors. In the current climate, scale and scope must be balanced so that oversupply of students in a particular sector is avoided.

### **IMPLEMENTATION**

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

TIO is currently a relatively small department in terms of academic staff. The number of administration staff is comparatively small when associated with the number of active students. Even though the two existing administration staff are very capable, the limited capacity creates an overspill towards the academic staff. Such additional burden on academic staff does not allow freeing up time to focus more on academic activities such as research and scholarly activities, external funding acquisition, industry collaborations at national, EU and international levels, etc. In other words, the full potential of the very able academic staff is not utilized, thus benefits for staff and students are not maximized.

- Form and function of academic services and infrastructure for students (e.g. library, PCs and free internet access, student counseling, athletic- cultural activity etc.).

In brief, the infrastructure for students in terms of library, PCs and internet access is

excellent. Library must benefit from extra hard and / or CD copies of compulsory reading books enlisted in each subject. This will minimize the anxiety that students encounter at the start of each semester. It seems that the cultural activities are diverse and plentiful. Whilst the athletic activities appear to lack of variety and formality.

#### RESULTS

- Are administrative and other services adequate and functional?

As mentioned above the administration services are adequate and currently are substantially supported by the academic staff involvement. This is unproductive and does not make economic sense. Academic staff must focus more on academic activities that benefit more the TIO, students, industry and society.

- How does the Department view the particular results.

TIO is aware that academic and student benefits can be maximized if adequate administration support is provided and resolution of this issue in the short term will be followed by tangible outcomes.

#### IMPROVEMENTS

- Has the Department identified ways and methods to improve the services provided?

TIO has identified ways and methods to improve services provided included more emphasis on e-class / e-learning to aid teaching outcomes by supplementing classroom and laboratory materials and thus reinforce and enhance student performance. E-class is a very good initiative and can be extended to e-tutorials also, so that student interest and enthusiasm is maintained throughout the course of study and in each subject area.

### **Collaboration with social, cultural and production organizations**

Please, comment on quality, originality and significance of the Department's initiatives.

TIO has exhibited commendable originality since its inception. Significant steps have been made since then to enrich such initiatives and pioneering work within the national context. In its recent form, TIO is enjoying distinct importance and kudos in the academic and industrial (private and government) sectors alike. TIO collaborates with other universities in Greece and EU, as well as credible and esteemed research organisations at national and international levels. Its links with most industry players and private and government hospitals in Athens are excellent and must be maintained since they provide pathways for student employment, research collaborations and potentially future commercialisation of any emerging intellectual property that may be developed. Indeed, this lifeline between TIO and industry at large must be continued and further strengthened. This can be achieved via the existing excellent alumni that TIO has established over the years.

### ***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.*

Please, comment on the Department's:

- Potential inhibiting factors at State, Institutional and Departmental level, and proposals on ways to overcome them.

Inhibiting factors at State level have been many in the past. But it appears that the new legislation and processes can provide a better framework for TEI and TIO to develop with a greater degree of autonomy and flexibility their own future and destiny. Most TIO staff have embraced such new changes. At the Institutional level, the inhibiting factors are mainly associated with the inability to rationalise and integrate complementary activities between departments and schools, especially those interdisciplinary ones and even more those that benefit from academic kudos and enjoy most influential status in the society. At the School level also, as TIO currently exists, the synergies between departments have not been fully explored thus leaving TIO to develop in depth rather than in breadth, and consequently jeopardise its true interdisciplinary nature.

- Short-, medium- and long-term goals.

It is very difficult for anyone to plan for any medium and long term goals, especially under the turbulent environment that exist in both the education and healthcare sectors in Greece. New changes require time for implementation. Thus, only short term specific goals and general future aspirations can be considered. In this respect TIO has proposed the development of an UG course in Biomedical Engineering and potentially a Masters. The latter can be established more readily whilst the former should be Biomedical Technology rather than Engineering or Science for obvious reasons, more aligned with national environment and TEI mission. An UG degree in Biomedical Technology will further require broadening the existing highly specialised TIO staff in narrow technological areas and at the same time incorporate the involvement of other departments in the same school and indeed other schools. In brief, a truly interdisciplinary effort is needed to deliver a credible interdisciplinary degree offering. This will also require the input of relevant organisations / industries. With respect to the Masters degree level, TIO needs to think laterally and identify future industry needs in order to match PG degree offerings. If marketing and sales, for example, are the major career prospect areas and major destinations of most graduates, then this should be the focus of the Masters degree. TIO's plan must include diversification in terms of technologies on research and teaching. This will allow students to rip the benefits of a wider spectrum of career prospects in industry and capitalise on more choices.

- Plan and actions for improvement by the Department/Academic Unit

Improvements should focus also in the area of synergies exploration with other departments and schools. In this respect, the acquisition of additional qualified staff internal to TEI through amalgamation of departments and / or schools, or externally acquired, need to be considered and a well thought plan together with time framed actions needs to be in place.

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

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

The goals and objectives of the Department are clearly set out in the internal evaluation report. The Department aims to provide a complete and coherent educational program in the field of biomedical technology and instrumentation and to promote research and development in the field. The Department is unique in the country in offering a course in the field of biomedical technology and instrumentation.

A high level of interaction of the Department with the industry (hospitals and companies active in the field) as well as with national and international academic groups (through teaching and research collaborations) has assisted the update of the curriculum to current high standards and should continue to do so.

Engagement of the industry (companies active in the field, hospitals, ex-graduates, potential employers etc) is pivotal both for curriculum development and the professional orientation of students.

A considerable part of the teaching program relies on external short-term hourly-paid staff. Instead the Department should exploit collaborative arrangements with other Departments and Schools that offer complementary expertise.

Continuous student progress evaluation with the introduction of midterm examinations, availability of e-tutorials and extended library hours with multiple copies of the prescribed textbooks are necessary for improvement of student performance. A system in which TIO academic staff serves as an advisor for students and help them navigate difficulties either with learning and/or life at large.

A program of visiting professors either from industry or academia would be beneficial.

A strategic plan must be developed which should encompass areas that are not represented currently. TIO's plan must include diversification in terms of technologies on research and teaching. This will allow students to rip the benefits of a wider spectrum of career prospects in industry and capitalise on more choices.

Continue the pursuit of externally funded research programs.

Improve the laboratory space allocated for research and teaching, considering the expansion of currently funded research as well as health and safety issues.

Consider reducing the amount of administration performed by academic staff, so that they can focus on teaching and research activities.

The Members of the Committee

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