ΕΛΛΗΝΙΚΗ ΔΗΜΟΚΡΑΤΙΑ

Α.Δ.Ι.Π.

ΑΡΧΗ ΔΙΑΣΦΑΛΙΣΗΣ ΚΑΙ ΠΙΣΤΟΠΟΙΗΣΗΣ ΤΗΣ ΠΟΙΟΤΗΤΑΣ ΣΤΗΝ ΑΝΩΤΑΤΗ ΕΚΠΑΙΔΕΥΣΗ

HELLENIC REPUBLIC

H.Q.A.

HELLENIC QUALITY ASSURANCE AND ACCREDITATION AGENCY

EXTERNAL EVALUATION REPORT

DEPARTMENT ...Chemical Engineering.....

UNIVERSITY /TEI.....University of Patras.....

European Union
European Social Fund

OPERATIONAL PROGRAMME
EDUCATION AND LIFELONG LEARNING
investing in knowledge society
MINISTRY OF EDUCATION & RELIGIOUS AFFAIRS, CULTURE & SPORTS
MANAGING AUTHORITY

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External Evaluation Committee Composition

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

1. Prof Vasilios I. Manousiouthakis (Coordinator)
   (Title) (Name and Surname)

   University of California at Los Angeles Chemical and Biomolecular Engineering
   (Institution of origin)

2. Prof Antony N. Beris
   (Title) (Name and Surname)

   University of Delaware, Chemical & Biomolecular Engineering
   (Institution of origin)

3. Prof Prodromos Daoutidis
   (Title) (Name and Surname)

   University of Minnesota, Chemical Engineering & Materials Science
   (Institution of origin)

4. Prof Alexander Mitsos
   (Title) (Name and Surname)

   RWTH Aachen University, Aachener Verfahrenstechnik
   (Institution of origin)

5. Prof Christos G. Takoudis
   (Title) (Name and Surname)

   University of Ilinois Chicago, Bioengineering/Chemical Engr.
   (Institution of origin)

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

- For dates, people met and facilities visited, see attached schedule
- The reports provided to the committee are
  - External evaluation reports (1999, 2004)
  - Internal evaluation reports (2007-2011 and 2008-2013)
  - Guide of Studies (2010-2011, 2013-2014)
  - Appendices including CVs
  - Presentations of evaluation visit
  - Additional administrative data (details of teaching load, success rate in every subject)
  - Brochures of university and department
  - Governing laws

II. The Internal Evaluation Procedure

- The material provided is complete and of excellent quality
- The department has done an outstanding job in the internal evaluation process
- The department organized an excellent visit with excellent participation of faculty
- The department was very responsive in our requests for changes of the programs

Conclusions

1. CURRICULUM
    1. **The undergraduate curriculum is rich and covers most chemical engineering related subjects in depth and in breadth at a high level comparable to the best universities worldwide.**
    2. The industrial internship (πρακτική άσκηση) offered as an elective is an important and effective option that has been made available to the students, and may play an effective role in improving job prospects.
    3. There is a very well-developed curriculum at the graduate level in both core and elective classes as well as classes outside the department. The graduate program attracts high-quality students from several disciplines and universities.
    4. The administration of the graduate programs at the Masters and PhD levels is thorough and streamlined close to the standards found in American universities.

2. TEACHING
    1. The selection of the textbooks is wisely made and is among the best available.
    2. Everybody (faculty, teaching assistants and staff) in the department participates equally in teaching and often beyond the required number of hours.
    3. The department has been proactive in developing and implementing regular teaching evaluations.
    4. It is commendable that graduate courses and Theses can be delivered and written, respectively, in English.

3. RESEARCH
    1. **The department overall performs research at an excellent level and can be considered among the top European chemical engineering departments.**
    2. Many of the faculty have very high success rate in securing funding from national and European competitive research programs. Some are coordinating big research programs.
    3. The department has established many successful collaborations with international institutions.
    4. The performance metrics, such as number of publications, citations and h-index, are very satisfactory.
    5. The Institute of Chemical Engineering Sciences is an important resource available to the faculty. This can be especially helpful to newly recruited faculty in the department.

4. OTHER SERVICES
    1. Through a substantial personal effort of the faculty and via competitive research funds, the department has acquired experimental research equipment that covers the present needs. The equipment is housed in the university and in the Institute of Chemical Engineering Sciences (IEXMH). There is an obvious and documented need for maintenance and service of the infrastructure at both the department and university level. On top of the maintenance, there is a continuing need to purchase new-generation equipment.
    2. There is a commendable collegial atmosphere in the department and a sense of common purpose in its teaching and research missions.
    3. It is commendable that technology transfer to industry and through spinoff companies has already occurred and the department promotes this.

Recommendations

As the committee developed its recommendations, we recognized that especially during a period of financial crisis, such as the current one in Greece, emphasis has to be placed on a) saving resources, b) rearranging resources and c) generating resources. These can be enabled, e.g., through

1. Transferring funds from textbook purchases to scientific journals electronic subscriptions.
2. Promoting staff reallocations enabled through continuing education.
3. Generating new resources, e.g., by offering the Masters programs to non-EU students.

1. CURRICULUM

1. Recommendations to department

1. The department currently has an excellent Masters program (ΜΔΕ) which can be delivered in English when needed. **They should consider expanding the reach of the program to non-EU students**, to whom they should charge an appropriate tuition. This can generate unrestricted funds for the department that are especially critical when there is loss of funds from other sources. In addition, a classes-only option may be worthwhile to be considered.
2. If the university decides to follow the promotion of online Masters programs, the department should actively embrace this.
3. The department should consider decreasing the number of units (ECTS) required in the undergraduate curriculum, in order to reduce the time to graduation, improve the students' academic performance and thus enhance the quality of education. In parallel to reducing the number of classes taught, the department could consider multiple offerings of core classes, which is especially important in the face of increasing student population. The multiple offerings can also be used to facilitate the satisfaction of prerequisites (see below).
4. We see several areas for streamlining the undergraduate curriculum. Examples:
    a. Strengthen the teaching of numerical methods by covering more thoroughly computational platforms, such as Matlab (or open-source alternatives such as GNU Octave, FreeMat, and Scilab), early in the curriculum. The students should also use computational methods to solve chemical engineering problems throughout the curriculum.
    b. Introduce a seminar-type course in the freshman year (1 teaching unit, 1ECTS) that will expose students to the chemical engineering curriculum and profession. The course can be used to motivate the students for their future studies and career. It could precede or be integrated with the existing Introduction to Chemical Engineering (XM140) class.
    c. We note that there is a microbiology course (XM680) without a biology course. There seems to be a lack of coverage of biochemistry.
    d. Whenever possible, introduce examples in each fundamental course (υποβάθρου) from core (περιοχής) courses, in order to better motivate the students.
    e. The department should consider offering a business course tailored to chemical engineers, and similarly an economics course tailored to chemical engineers. These would be alternatives to the current electives offered by other departments, which according to students do not make a strong connection with chemical engineering.
    f. There are courses that can be consolidated or moved to electives. For

example: Introduction to Chemical Engineering (XM140) and Technical Thermodynamics and Balances (XM540) could be consolidated and moved to the third semester. Physical Chemistry II (XM520) could be an elective. Transport phenomena could be condensed from three semesters (Fluids, Mass, Energy) to two semesters. One of the two materials courses (XM480 and XM380) could be an elective, especially since XM480 seems to have big overlap with Physics II (XM230). These changes may require rethinking the electives offered and considering offering some of the ones that do not attract many students every other year.

5. We strongly encourage the department to establish and enforce a minimum number of prerequisites. Each fundamental course (υποβάθρου) should be a prerequisite to at least one core course (περιοχής), and inversely each laboratory course (ανάπτυξη δεξιότητας) should have core prerequisites.
6. The use of the electronic class management system eclass (https://eclass.upatras.gr/) is commendable and should be further enhanced and expanded throughout the department

2. Recommendations to university
    1. The university should consider the creation of online Masters programs delivered in the English language to reach people out of campus, to whom appropriate tuition should be charged. This has the potential of generating substantial income and increasing the international recognition and visibility of the university. Potentially, lab classes can be offered in the summer, when the teaching laboratories are underutilized. This undertaking requires substantial effort and resources and thus funds would be required, e.g., from ESPA.

3. Recommendations to government
    1. The government should facilitate the job placement of qualified engineers in industry. One of the ways to achieve that is by supporting programs such as the internship organized by the Chemical Engineering Department in Patras. This can be part of a stronger interaction between university and industry.

2. TEACHING

1. Recommendations to department
    1. **The department should find ways to motivate students and ensure they attend classes and participate in the educational process.** Possible ways include: compare success rate for those attending versus those not attending; introduce graded quizzes that contribute to the final grade; offer multiple sections of the same class, especially when the attendance is high.
    2. The department participates in many exchange programs (ERASMUS, etc.), but the participation of students is very small. The department should address potential problems, such as possible adverse impact on duration of studies and late notification of available positions due to university-wide selection process.
    3. The department should provide significantly more opportunities for hands-on experience even in advanced teaching laboratories.
    4. The department should enhance safety training and provide formal safety certification through test-taking.
    5. When computer presentations are used for teaching, they should be provided to the students ahead of the lecture.
    6. The committee notes a potential in more widespread use of free online

instructional resources such as instructional videos, through google/youtube, the Khan academy, MIT, etc. This could mitigate problems from delays in the delivery of textbooks and even alleviate the need for the use of expensive textbooks, if the budget restrictions become overwhelming.

7. The course evaluation could include questions about material learned and how this correlates with the predefined course objectives.

2. Recommendations to university
   1. Incentives for excellence in teaching should be created, such as a teaching award for faculty at the university level.
   2. Sufficient funding for maintenance and consumables for teaching laboratories should be provided, to allow effective use of the high-quality laboratories available.
   3. The university should consider establishing formal teaching assessment methods in addition to instructor and course evaluation. These could be used to improve the rate of success but without of course compromising academic standards.
      A means to achieve this is to enhance eclass' functionality to keep records of the detailed statistics of each course taught (number of students registered, number of students taking the exam, success rate in the exam, instructor and course evaluation, etc.). Each department should create a feedback mechanism, that can quantify whether course and program objectives are met, and to identify corrective actions whenever necessary.

3. Recommendations to government
   1. Books provided by Εύδοξος system are given to students late in the semester, as documented also in the report of the internal evaluation committee. The textbook selection should be done ahead of the semester in order for the books to be available at the beginning of the semester. The budget used for the books at a national level is very high in comparison to the library budget. An alternative may be to have multiple copies (possibly electronic) of the textbooks reserved in the library.
   2. The number of entering students should be set with specific metrics, and the decision criteria should be made transparent to the university and departments.

3. RESEARCH

1. Recommendations to department
   1. **The strengths of the department should be advertised in an organized form to the public in order to enhance the reputation of the department, the profession of chemical engineering, and the university.**
   2. The department should institute a regular webinar with at least the other two Hellenic chemical engineering departments to facilitate scientific exchange with little cost and effort. This webinar should be part of the regular seminar series. The seminar series should be taken for academic credit by the graduate students.
   3. The department should reinforce its efforts in hiring faculty that have obtained their doctorate degrees and/or have proven successful academic records in top international universities.
   4. The department should participate together with the university to establish startup funds for new faculty.
   5. We strongly encourage the faculty to expand collaborative interdisciplinary research efforts within the department. This reflects modern research trends

and can result in significantly enhancing scientific output and impact.

6. The department should think about ways to promote and/or participate in research efforts that would lead to new research developments that require low capital cost for their technological deployment and could thus become nuclei of home-grown technology companies.
7. The number of female faculty is currently very low (only one). If possible, encourage hiring of female faculty members.

2. Recommendations to university
    1. The university should develop mechanisms to facilitate technology transfer, for example through the establishment of an intellectual property office.
    2. The increased focus on connecting the university to the market place will increase the likelihood that faculty will get involved with start-up (spinoff) or other companies licensing technology developed at the university. It is therefore imperative that guidelines be in place that govern the potential conflicts of interest.
    3. The university should develop mechanisms to assist investigators with proposal preparation and submission.
    4. The university should establish a clear university-wide policy, e.g., fixed-percentage, of returning to the departments part of the overhead generated by the department. This will serve as an incentive to attract external funding.
    5. The high degree of bureaucratic procedures results in delays in purchasing important equipment and required materials. The university should develop an effective system for procurement.
    6. The university should establish startup funds for newly hired faculty. These funds can come from overhead collected from research grants, as well as from the university budget, or new programs, such as the suggested Masters program.
    7. The central electron microscopy facilities (SEM/TEM), which find significant use by both departments and external users, need to have a fair fee structure (the current fees are rather low) and to require in advance an active account for the services provided. The funds collected need to be used to continue the support, maintenance, and upgrade of the central facilities.
    8. The university should promote and actively advertise successes in research or funding, and should develop mechanisms to reward excellence.

3. Recommendations to government
    1. It is imperative to make every effort to at least sustain the current level of support for electronic scientific journal library subscriptions.
    2. It is important to develop programs and mechanisms to help assistant professors to launch their independent research careers, for example, startup funds and research programs targeted to young investigators.
    3. The strategic planning at the department and university level is hindered by frequent changes in legislation and funding opportunities. Creating a stable legal framework and announcing in advance calls for proposals and positions, would allow excellent departments to be proactive in planning.

4. OTHER SERVICES

1. Recommendations to department
    1. **The department should advertise the chemical engineering profession and the undergraduate program to local high schools, through visits of faculty and short seminars, or through visits of students to the department.**

2. The department should increase the efforts to connect with alumni, e.g., by finding successful ones and bringing them to the department to give seminars. The department should also consider alumni fund raising.

2. Recommendations to university
    1. There is an obvious and documented lack of money for maintenance of the infrastructure, at both the department and the university level. As an example, an alarming incident occurred in the central microscopy facilities (which include SEM/TEM): a water leak occurred near expensive equipment. Two issues need to be addressed: the funding level needs to be increased, and the bureaucracy decreased. A specific measure that could be undertaken, would be to reestablish the department's maintenance allocation; at least 20k€/year are anticipated to be needed for this purpose.
    2. The committee suggests that the university undertake continuing education (retraining) of its personnel, to enhance their mobility within the university. This can be done via open-university courses, or after-hour seminars, that would allow the staff to acquire new skills suitable for high-demand positions.
    3. Transportation and housing appear to be points of concern to the students. Transportation to and from the university should be more frequent and coordinated with the class schedule. University housing should be made available only to active students.

3. Recommendations to government
    1. A potential mechanism to overcome the financial crisis is through innovation. There is a small number of startup companies already created as university spinoffs. The creation of spinoffs has to be further encouraged and needs resources, e.g., for patent submission and support, and most importantly much less bureaucracy. **A potential mechanism to promote this is through funding programs specifically targeted to startups, such as the SBIR (Small Business Innovation Research) funded by the NSF in the USA**.

The Members of the Committee

	Name and Surname	Signature
1.	Vasilios I. Manousiouthakis	
2.	Antony N. Beris	
3.	Prodromos Daoutidis	
4.	Alexander Mitsos	
5.	Christos G. Takoudis	

SCHEDULE OF THE EXTERNAL EVALUATION COMMITTEE SITE VISIT

DEPARTMENT OF CHEMICAL ENGINEERING - UNIVERSITY OF PATRAS

SUNDAY, NOVEMBER 24

Arrival in Athens, Hotel Accommodation for those who asked for Divani Palace Acropolis Parthenonos 19

23 Athens, Akropoli

MONDAY, NOVEMBER 25

09:30 - 11:00	Visit of the committee members to the Hellenic Quality Assurance and Accreditation Agency offices **– 44 Syngrou Avenue 5th Floor** Information session regarding the procedures and forms of the evaluation
11:30	Departure from our offices –Travel to Patra * **The Department will take care for the transportation of the EEC members*
~ 15:00	Arrival in Patras (Achaia Beach hotel)
	The Department will take care for the transportation of the EEC members
~ 15:00	Arrival in Patras (Achaia Beach hotel)
16:00 - 17:00	Meeting with the Rector, the Vice Rector of Academic Affairs, the Chairman of the Department and members of the Internal Evaluation Committees (OMEA and MODIP)
17:00 - 17:30	Presentation of Department (Prof. Dimitris Mataras)
17:30 - 18:00	Presentation of Program of Undergraduate Studies (Prof. Spyros Ladas)
18:00 - 18:30	Coffee Break
18:30 - 19:00	Presentation of Program of Graduate Studies (Prof. Vlassis Mavrantzas)
19:00 - 19:20	Practical training- Mobility- Safety (Prof. George Angelopoulos)
19:20 - 20:00	Research Overview (Prof. Soghomon Boghosian)
~ 20:00	Committee returns to Achaia Beach hotel
21:00	

TUESDAY, NOVEMBER 26

09:00 - 09:15	Res. activities 1: Polymer Science and Technology (Prof. C.Tsitsilianis)
09:15 - 09:30	Res. activities 2: Surface, Interface and Thin Film Science and Technology (Ass. Prof. E.Amanatides)
09:30 - 09:45	Res. activities 3: Catalytic and Electrochemical Processes (Assoc. Prof. D. Kondaridis)
09:45 - 10:00	Res. activities 4: Applied Physical Chemistry and Materials Technology (Prof. P.Koutsoukos)
10:00 - 11:15	Meeting with undergraduate students
11:15 - 11:30	Internal Discussion and Lunch Break
11:30 - 12:00	Meeting with postdoctoral researchers
12:00 - 14:00	Visits to research laboratories
14:00 - 16:00	Visit to Institute of Chemical Engineering Sciences -
16:00 - 16:15	Res. activities 5: Systems Engineering (Prof. C.Kravaris)

16:15 - 16:30	Res. activities 6: Environmental Biotechnology, Waste Valorization and Sustainable Management of Natural Resources (Ass. Prof. M.Kornaros)
16:30 - 16:45	Res. activities 7: Environmental Chemical Engineering (Prof. D.Mantzavinos)
16:45 - 17:00	Res. activities 8: Transport Phenomena, Computational Engineering (Prof. J.Tsamopoulos)
17:00 - 17:30	Coffee break
17:30 - 18:30	Visits to educational laboratories
18:30 - 19:00	Conclusions of Internal Evaluation - Plans for improvement (Prof. Spyros Pandis)
19:00 - 21:00	Meeting of committee members in the Achaia Beach hotel
21:00	

WEDNESDAY, NOVEMBER 27

08:30 - 09:00	Meeting with Department Secretary and administrative staff *Meeting canceled due to strike*
09:00 - 09:30	Meeting with technical staff
09:30 - 10:45	Meeting with graduate students
10:45 - 11:00	Coffee break
11:00 - 11:45	Meeting with assistant professors
11:45 - 12:00	Internal discussion
12:00 - 12:45	Visits to research laboratories
12:45 - 13:30	Visit to selected university facilities
13:30 - 14:00	Meeting with Chairman of the Department, Chairman of the Internal Evaluation Committee and Chairman of the University Quality Assurance Unit
14:00 - 14:15	Meeting with the Rector, the Vice Rector of Academic Affairs
~16:00	Departure for Athens

THURSDAY, NOVEMBER 28

09:00 - 18:00	Preparation of the Draft External Evaluation Report in space provided by the Hellenic Quality Assurance and Accreditation Agency (**Adip Offices 44 Syngrou Avenue 5th Floor**)

FRIDAY, NOVEMBER 29

09:00 - 18:00	Preparation of the Draft External Evaluation Report in space provided by the Hellenic Quality Assurance and Accreditation Agency **(Adip Offices 44 Syngrou Avenue 5th Floor**)

SATURDAY, NOVEMBER 30

Completion of the Draft External Evaluation Report.

Departure of the committee members from Athens