COUNCIL FOR HIGHER EDUCATION

המועצה להשכלה גבוהה

Committee for the Evaluation of Physics Studies

Jerusalem College of Technology

Department of Applied Physics

Evaluation Report

December 2007

Contents

Chapter 1- Background

At its meeting on March 8, 2005 the Council for Higher Education (CHE) decided to evaluate study programs in the field of Physics during the academic year 2005-2006.

Following the decision of the CHE, the Minister of Education, who serves ex officio as the Chairperson of the CHE, appointed a committee consisting of:

- ***Prof. Hanoch Gutfreund*** - The Racah Institute of Physics, The Hebrew University, Committee Chairman.
- ***Prof. Daniel Ashery*** - School of Physics and Astronomy, Tel Aviv University.
- ***Prof. Moshe Deutsch*** - Department of Physics, Bar Ilan University.
- ***Prof. James Langer*** - Department of Physics, University of California Santa Barbara, U.S.A.
- ***Prof. Stephen Lipson*** – Faculty of Physics, the Technion, Haifa.

Ms. Alisa Elon- Coordinator of the committee on behalf of the Council for Higher Education.

Within the framework of its activity, the committee was requested to:

1. Examine the self-evaluation reports, which were submitted by institutions that provide study programs in Physics, and hold on-site visits to those institutions.

2. Present the CHE with final reports for the evaluated academic units and study programs - a separate report for each institution, including the committee's findings and recommendations, together with the response of the institutions to the reports.

3. To submit to the CHE a report regarding its opinion of the examined field of study within the Israeli system of higher education. The committee will submit a separate report to the CHE in this matter.

The committee's Terms of Reference document is attached as **Appendix 1**.

The first stage of the quality assessment process consisted of self-evaluation by the institutions. This process was conducted in accordance with the CHE's Guidelines for Self-Evaluation (of October 2005) and on the basis of the committee's specific instructions, as set forth in their letter to the institutions dated December 21, 2005.

Chapter 2-Committee Procedures

The committee held its first meeting on March 26, 2006 during which it discussed fundamental issues concerning Physics study programs in Israel and its quality assessment activity.

During the period June-July 2006 the committee members received the self-evaluation reports.

In November 2006, the committee members conducted a full-day visit to each of the institutions offering study programs in the field under examination. During the visits, the committee met with the relevant officials within the organizational structure of each institution, as well as faculty and students.

This report deals with the Department of Applied Physics at Jerusalem College of Technology.

The committee's visit to the Jerusalem College of Technology took place on November 13, 2006. The schedule of the visit, including the list of participants representing the institution, is attached as **Appendix 2**.

The committee members thank the management of the College and the Department of Applied Physics for their self-evaluation report and for their hospitality towards the committee during its visit.

Chapter 3- Evaluation of the Department of Applied Physics at Jerusalem College of Technology.

The Institution

The Jerusalem College of Technology (JCT) is unique in its mission of serving primarily orthodox students who wish to combine religious education with training in applied science. This mission imposes severe constraints on the academic functions of JCT. All students spend their mornings in religious studies, and take their physics and other courses only in the afternoons. There are two main campuses, one for men at Machon Lev and a second for women at Machon Tal (established five years ago). All courses are taught separately at each campus, with identical assignments and exams; thus the teaching responsibilities of the faculty are effectively doubled.

As emphasized by President Bodenheimer at the beginning of our site visit, JCT is committed to providing such students with a first degree that will be useful to them – not just a preparation for advanced studies. JCT has been quite successful in this mission during its thirty-seven year history. Its graduates now hold responsible positions in Israeli industry and in the defense forces, and in a number of cases have started their own high-tech companies.

The Physics Programs

The Applied Physics Department at Jerusalem College of Technology is unique among the seven physics departments in Israel in that it grants only bachelor's degrees. Its curriculum still focuses primarily on its historic specialty of electro-optics; but two years ago it added a separate degree program within the Department in medical engineering.

The JCT Applied Physics BSc program is a four-year curriculum that is sharply focused on topics related to optical instrumentation and image processing. The well established part of this program is the electro-optics curriculum, which was one of the original degree programs at JCT (B. Tech degree in Electro-Optics for about thirty years), and which epitomizes the applications-oriented focus of the College.

The new medical engineering program specializes in medical instrumentation and imaging; its graduates will be primarily applied physicists rather than engineers or medical specialists. The curriculum consists of about 70% of courses in physics and mathematics and 30% of courses (all mandatory) in biochemistry, physiology and imaging. The Heads of JCT and the Department insist that the graduates of this program, like those of the applied physics program, are primarily physicists. We sensed that there still exists some dissatisfaction with the present name of the program – Medical Engineering and not Medical Physics. We are not taking a position on this issue, except for noting that this reflects a continuing, very positive, concern about the nature and contents of this program.

Both programs are four-year programs and both have a heavy load of contact classes. The curriculum is rigidly structured and mostly mandatory and there are very few elective courses. In particular, there is a lack of general courses in physics. Students (see below) and faculty have mentioned this as one of the serious shortcomings of the two programs. Also, students (see below) and faculty criticized the lack of basic courses on biomedical systems and processes and the need to compensate for this during their project work. We also heard that courses in mathematics, taught by mathematicians, are poorly coordinated in time and content with the physics courses. As a result, a significant part of the physics courses are devoted to covering the necessary mathematical background. The academic leadership of the Department should take these remarks seriously.

In our opinion, the most serious problem that has to be addressed without delay, is that the program offered at the separate women's campus, Machon Tal, is – according to reports that we heard from both faculty and students – markedly inferior to that at the men's

campus, Machon Lev. Lecturers who teach on both campuses praised the high academic level and the motivation of the women students, yet the level of education provided at Tal is often not of the same quality as at Lev. This gap is particularly apparent when comparing the quality of the teaching laboratories on the two campuses (see below).

The Teaching Laboratories

There are no laboratory courses at all offered in the first year. In the second year, the experiments are very simple mechanics and optics exercises. In the third year there are somewhat more advanced experiments and students in both academic tracks have to carry out project work. For this they are allocated dark rooms and can choose from the available equipment. In the last year there are several laboratories – a joint electro-optics laboratory for both tracks and full year project-work, sometimes in Industry, specific to each of them. The medical engineering students are introduced to equipment used in clinics so that they can learn something about the capabilities and limitations of such instruments.

We found the quality of the teaching laboratories, even at Machon Lev, to be relatively poor. Most projects, including the more advanced ones in the fourth year of the program, consist of cook-book experiments where the students are given little opportunity to be innovative or even to learn much about basic principles from their laboratory experiences.

We did not visit the women's campus, but judging by what we heard from the students and the instructors about the conditions of the teaching laboratories there, which are all taught in one room using equipment brought irregularly from the men's campus, we dare to say that these conditions are unacceptable.

The Faculty

The faculty consists of six tenured full and associate professors plus about twenty-six other lecturers and external teachers. Despite the heavy teaching load, most of the full time

faculty is engaged in research, at least to some degree. In this context we wish to point out the strong experimental research program in photovoltaics and related topics carried out by Professor Eisenberg with support from industry, NASA, and elsewhere.

One of our major concerns is faculty development. The main mission of JCT is to prepare students to play responsible roles in rapidly advancing areas of applied science. Because of their heavy teaching loads, however, instructors at JCT have little opportunity to keep up with modern developments in their fields. These instructors are not temporary, graduate-student teaching assistants as at universities but, rather, are people who must see their positions at JCT as long-term employment. Thus it seems to us that the challenge of maintaining a well-informed and scientifically up to date faculty at JCT is particularly acute. As we shall note below, it would be very hard for the College to support a substantially broader or more advanced curriculum under these circumstances.

The Students

On the positive side, our committee was well impressed by some special efforts that the department and the College have made to work within the constraints implied by the mission of JCT. There is a Director of Academic Quality and Development (Meir Komar) who has a broad portfolio of responsibilities including making sure that the courses are well taught and coordinated with each other, and that the students are properly guided and evaluated. There is also a Head of Ties to Industry (Chaim Rosenfield) who works energetically to make contacts with industry and to find job opportunities for students.

The students with whom we talked were generally quite positive about the support they receive from the faculty and staff, but told us that they find the curriculum to be too narrow and rigid. There are very few optional courses, and it is impossible to take courses in other departments – not even in computer science – because of scheduling constraints. On the other hand, some of them complained about many repetitions in courses, which indicates lack of coordination between curricula. As a specific example, they mentioned the course on magnetic fields which teaches all of the infinitesimal calculus that is covered in one of

the courses in mathematics. Similarly, the medical engineering students told us that they need more courses in bio-medical subjects to supplement their purely physics-oriented curriculum. In these complaints, of course, the students are coming up against the constraints imposed by their own choice of a combined religious and technical education. All of those with whom we spoke cited the religious program as their main reason for choosing JCT. With the limited time available for technical courses, the College and the Department cannot possibly expand the curricula in major ways while maintaining the institution's commitment to both the religious and scientific programs.

Summary

In summary, we applaud the College for making it possible for orthodox students, and especially women, to be trained in applied sciences. We see this mission as an uniquely important contribution to society. To carry it out effectively, the College and the Applied Physics Department will need to set their priorities carefully and work within the limitations implied by their goals. Having said that, we wish to point out that it was not clear to us to what extent was the change of the title from B. Tech. in electro-optics to B. Sc. in applied physics more than just a change in name. We strongly recommend that the top priority be to resolve the discrepancy in academic standards between the women's and the men's campuses. Another acute problem requiring prompt attention and improvement is the quality of some of the teaching laboratories, as detailed above. We also recommend that the Department give high priority to adding some diversity to its curriculum, perhaps by reorganizing existing courses, eliminating redundancies in their content, or otherwise making adjustments to allow students to learn about subjects not directly related to their specialties. We wish to reemphasize the importance of the points raised above under the topic of 'faculty development', specifically maintaining an informed and up-to-date junior faculty of instructors assisting in course-works and laboratories. We believe that the College and the Department should address these issues before attempting to expand into new areas of applied physics or add advanced degree programs.

Signed By:

Prof. Hanoch Gutfreund
Chairman
On behalf of the committee

APPENDICES

APPENDIX 1

Terms of Reference of the Committee

COUNCIL FOR HIGHER EDUCATION המועצה להשכלה גבוהה

18 October 2006

To:

Prof. Hanoch Gutfreund - The Racah Institute of Physics, the Hebrew University
Prof. Daniel Ashery - School of Physics and Astronomy, Tel Aviv University
Prof. Moshe Deutsch - Department of Physics, Bar Ilan University
Prof. James Langer - Department of Physics, University of California Santa Barbara, U.S.A.
Prof. Stephen Lipson- Faculty of Physics, the Technion, Haifa

Esteemed Gentlemen,

I hereby appoint you as members of the Council for Higher Education's (CHE) Committee for the Evaluation of Physics Studies within institutions of higher education in Israel.

You are kindly requested to operate in accordance with the Appendix to the Terms of Reference of Evaluation Committees (study-programs), which is attached to this Terms of Reference document.

The Committee is requested within the framework of its activity to:

1. Examine the self-evaluation reports which shall be submitted by the institutions that provide study-programs in Physics, and hold on-site visits to those institutions.
2. Present the CHE- by January 2007- with final reports regarding the evaluated academic units and study-programs- a separate report for each institution including the Committee's findings and recommendations, together with the institutions' responses to the reports.

Within the framework of the final reports, the Committee is requested to refer to the following topics, among others, in relation to each of the study-programs:

1. The goals and aims of the evaluated academic unit and study-programs.
2. The study-program and its standard.
3. The academic staff.
4. The students.
5. The organizational structure — both academic and administrative - of the academic unit and study-program.
6. The broad organizational structure (school/faculty) in which the academic unit and the study-program operate.
7. Physical and administrative infrastructure available to the study-program.
8. Internal mechanisms for quality assessment
9. Conclusions of the academic unit and the study-program.
10. Other topics to be decided upon by the Evaluation Committee.

In addition to its final reports concerning each study program under examination, the committee shall submit to the CHE the following documents:

1. A report regarding Physics Studies within the Israeli system of higher education.
2. A proposal concerning standards for Physics Studies.

Professor Hanoch Gutfreund shall preside over the Committee as Chairman.
Ms. Einav Broitman shall coordinate the Committee's activities.

Yours sincerely,

Yuli Tamir
Minister of Education
Chairperson of the Council for Higher Education

cc: Ms. Riki Mendelzvaig, Secretary of the Council for Higher Education
Ms. Michal Neumann, in charge of the Quality Assessment Unit
Ms. Einav Broitman, coordinator of the committee

Enclosure:
Appendix to the Terms of Reference of Evaluation Committees (study-programs).

November 2005

Appendix to the Terms of Reference of Evaluation Committees (Study-Programs)

1. General

On June 3, 2003 the Council for Higher Education (CHE) decided to establish a system for quality assessment and assurance in Israeli higher education. Within this framework, study-programs are to be evaluated once in six years and institutions once in eight years. The quality assessment system came into effect in the academic year of 2004-2005.

The objectives of the quality assessment activity are:

- To enhance the quality of higher education in Israel;
- To create an awareness within institutions of higher education in Israel of the importance of this subject and to develop internal mechanisms for the evaluation of academic quality on a regular basis;
- To provide the public with information regarding the quality of study programs in institutions of higher education throughout Israel;
- To ensure the continued integration of the Israeli system of higher education in the international academic arena.

It is not the CHE's intention to rank the institutions of higher education according to the results of the quality assessment activity. The evaluation committee is requested not to make comparisons between the institutions.

2. The Evaluation Committee

2.1 The CHE shall appoint a Committee to carry out quality assessment of the study-programs.

2.2 A senior academic figure in the examined field shall be appointed as Chairman.

2.3 The Committee shall include 3 to 5 senior academic figures in the field from leading institutions in Israel and abroad. In exceptional cases, and in cooperation with the committee chairman, an authoritative figure who is not on the academic staff of an institution of higher education may be appointed as a committee member.

2.4 In the event that a member of the committee is also a faculty member in an institution being evaluated, he will not take part in discussions regarding that institution.

3. The work of the Evaluation Committee

3.1 The Committee shall hold meetings, as needed, before visiting the institution, in order to evaluate the material received.

3.2 The committee shall visit the institution and the academic unit being evaluated within 3-4 months of receiving the self-evaluation report. The purpose of the visit is to verify and update the information submitted in the self-study report, clarify matters where necessary, inspect the educational environment and facilities first hand, etc. During the visit the committee will meet with the heads of the

institution, faculty members, students, the administrative staff, and any other persons it considers necessary.

3.3 In a meeting at the beginning of the visit, the committee will meet with the heads of the institution (president/rector, dean), the head of the academic unit and the study-programs, in order to explain the purpose of the visit. At the end of the visit, the committee will summarize its findings, and formulate its recommendations.

3.4 The duration of the visits will be coordinated with the Chairman of the Committee according to the issue, and in any event will not be less than one day.

3.5 Following the visit, the committee will write its final report, including its recommendations, which will be delivered to the institution and the academic unit for their response. The institution's and the academic unit's response will not result in changes to the content of the Committee's report, unless they point out errors in the data or typographical errors in the Committee's report. In such cases, the committee will be able to make the required corrections in its final report.

4. The Evaluation Committee's Report

4.1 The final report of the evaluation committee shall address every institution separately.

4.2 The final report shall include recommendations on the subjects listed in the guidelines for self-evaluation, and in accordance with the Committee's Terms of Reference.

4.3 The recommendations can be classed as one of the five following alternatives:

4.3.1 ***Congratulatory remarks and minimal changes recommended, if any.***

4.3.2 ***Desirable changes recommended*** at the institution's convenience and follow-up in the next cycle of evaluation.

4.3.3 ***Important/needed changes requested for ensuring appropriate academic quality*** within a reasonable time, in coordination with the institution (1-3 years).

4.3.4 ***Essential and urgent changes required, on which continued authorization will be contingent*** (immediately or up to one year).

4.3.5 ***A combination of any of the above.***

4.4 The committee's report shall include the following:

4.4.1 **Part A — General background and an executive summary:**

4.4.1.1 General background concerning the evaluation process, the names of the members of the committee, a general description of the institution and the academic unit being assessed, and the committee's work.

4.4.1.2 An executive summary which will include a description of the strengths and weaknesses of the academic unit and program being evaluated, according to the subjects listed in the body of the report and a list of recommendations for action.

4.4.2 **Part B — In depth description of subjects examined:**

4.4.2.1 This part will be composed according to the topics examined by the evaluation committee, in accordance with the committee's Terms of Reference and the report submitted by the institution, and at the discretion of the committee.

4.4.2.2 For each topic examined - the report will present a summary of the findings, the relevant information and an analysis thereof, and conclusions and recommended actions.

4.4.3 **Part C — Summary and recommendations:**

4.4.3.1 A short summary of every one of the topics described in detail in Part B, including the committee's recommendations.

4.4.3.2 Comprehensive conclusion/s and recommendation/s regarding the evaluated academic unit and the study-programs.

4.4.4 **Part D- Appendices:**

The appendices shall contain the committee's Terms of Reference, relevant information about the institution and the evaluated academic unit, the schedule of the on-site visit.

4.5 The final report will be delivered to the institution, with the deadline for its and the academic unit's response noted.

4.6 The Committee's final report together with the response of the institution and the academic unit will be brought before the CHE.

4.7 The CHE will discuss these documents and formulate its decisions within (approximately) a year from the time the guidelines for self-evaluation were sent to the institutions.

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APPENDIX 2

The schedule of the visit

פיזיקה - בג"ט

Time	Subject	Participants
09:00-09:30	Opening session with heads of the institution, the senior staff appointed to deal with the quality assessment and the heads of the academic unit	Prof. Yosef Bodenheimer, President Prof. Menachem Steiner, Rector Dr. Shimon Weiss, General Manager Mr. Zvi Weinberger, Department Chairman Prof. Yitzcak Leichter, Head of Medical Engineering Dr. Yoel Arieli, Head of Electro-Optic Engineering Mr. Meir Komar, Director of Academic Quality and Development
9:30 - 10:15	Meeting with the school's academic and administrative leadership - the decision makers of the academic unit	Mr. Zvi Weinberger Prof. Yitzcak Leichter Dr. Yoel Arieli Prof. Meir Nitzan Mr. Meir Komar
10:15-10:40	Meeting with representatives of various units effecting the academic unit - **Admissions and Student Services**	Dr. Motti Reif, Head ~~of Admission Committee~~ ~~Mrs. Sara Baim, Director of Admissions~~ Mr. Eli Shalman, Head of Student Authority Mr. Meir Komar
10:40-11:05	Meeting with representatives of various units effecting the academic unit - **Research and Industrial Ties**	Mr. Chaim Rosenfld, Head of Ties to Industry Unit Prof. Yacov Freidman, Head of Research Authority Mr. Meir Komar
11:05-11:30	Meeting with representivitves of various units effecting the academic unit - **Support Services**	Mrs. Chana Leicher, Head Librarian Mr. Yedidia Klein, Computer Center Mr. Meir Komar
11:30-13:00	Tour of Teaching laboratories, meeting with Teaching Assistants (labs' instructors)	Dr. Babechenko Mr. David Ben Ezra Dr. Simon Geffen Mr.Yoach Ivri Mr. Moshe Goldstein Mr. Yuval Schecter Mr. Chaim Brener
13:00-14:00	Lunch	Committee members
14:00-15:00	Meeting with senior academic staff*	Prof. Naftali Eisnberg Prof. Naftali Shweitzer Dr. Salman Noach Dr. Asher Peretz Mr. David Ben-Ezra Dr. Shlomo Goldin
15:00-16:00	Meeting with students*	8 names to be added here
16:00-17:00	Summary meeting with the head of the academic unit and the person in charge of quality in the institution	Mr. Zvi Weinberger Prof. Yitzcak Leichter Dr. Yoel Arieli Mr. Meir Komar
17:00-18:00	Closed meeting	Committee members