Committee for the Evaluation of Physics Studies

Bar-Ilan University

The Department of 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.
In order to prevent the appearance of a conflict of interests, committee members did not participate in visits to institutions in which they were faculty members. Therefore, Prof. Moshe Deutsch did not take part in the committee's visit to Bar-Ilan University.

This report deals with the Department of Physics at the Bar-Ilan University.

The committee's visit to Bar-Ilan University took place on November 15, 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 Bar-Ilan University and the Department of Physics for their self-evaluation report and for their hospitality towards the committee during its visit.

Chapter 3- Evaluation of the Department of Physics at Bar-Ilan University

The University

Bar-Ilan University, situated in Ramat-Gan, was founded by the National Religious movement in 1955. The campus, which is quite large considering that it is located in a densely-populated area, houses all the various Faculties, but provides only limited dormitory space for students. The total number of students is 17,600, and they belong to six Faculties. The Physics department is in the Faculty of Exact Sciences. A few years ago, a School of Engineering was established. Recently, funds were provided to found a Nanotechnology Institute and a Brain Research Institute; the former will certainly influence the Physics department considerably, and the latter in a minor way.

The Physics Department

The Physics Department has had a major influence on the University as a whole. Both the President and the Rector are members of the Department and received their doctorates from it. The Department has 24 faculty members, whose research interests are in condensed matter and optics and biophysics. In a small department, this restriction of the fields of research is a deliberate and successful attempt to establish and maintain a critical mass of researchers in a few fields. There are 196 undergraduate, 49 MSc and 44 PhD students.

The restriction of the fields of research has considerable impact on teaching, in that there are no obligatory or even elective courses in fields such as astrophysics, plasma physics or high energy physics. However, outside lecturers occasionally have been employed to teach such courses.

Faculty Development

The last major development in the faculty, the absorption of several members from the FSU in the early 1990s, was unplanned. This was followed by 5-6 years during which there was no hiring. There is now an opportunity to hire about 5 new people within the Nanotechnology Institute, which will make a total of 12 positions available to

Physics, Chemistry and the School of Engineering. The Brain Research Institute might also lead to positions in biophysics. Both of these Institutes fit the fields of research of the Department rather well, and clearly the Department needs to plan ahead in order to make the best use of these opportunities.

Teaching by the Faculty

The Physics faculty teaches all the courses in physics to physics students and a few service courses for other departments such as Life Sciences, Chemistry, Optometry Studies and Engineering. However, most of the service courses are taught by PhD students or outside lecturers, so that service teaching is not a heavy load on the faculty. Physics faculty members also teach all the mathematics courses which the physics students receive. Physics graduate students conduct all the exercise classes and laboratory teaching related to both physics and service courses. The faculty teaching load is 2-3 courses per year (not including seminar organization or administrative duties) and the average number of frontal hours is 7.5 per year (in which laboratory teaching is weighted by 0.25 compared to lecturing). The average number of student-hours taught per year to physics students is 189, which rises to about 270 when service teaching by faculty members is taken into account. This indicates an average class size of 36. Elective courses for which less than 8 students register are generally cancelled.

Undergraduate Teaching Program

Students can study under the auspices of the Physics Department in a number of options. All are three-year courses. One credit point at Bar-Ilan is equal to two hours of lecture, laboratory or exercise.

- **Expanded Physics**: 77.5 credit points (*including 31.5 classical physics, 16 modern physics, 5 laboratories, 17.5 mathematics)
- **Physics Major** (to be combined with another discipline): 56 credit points (*including 22.5 classical physics, 11.5 modern physics, 2.5 laboratories, 17.5 mathematics)
- **Physics Major and Mathematics Major**: 40 credit points in physics and 36.5 in mathematics

- **Physics Major and Computer Science Major**: 54 credit points in physics and 30.5 in computer science
- **Biophysics**: 73 credit points in physics, chemistry and life sciences.

*Classical physics = mechanics, electricity and magnetism, thermodynamics, waves, statistical mechanics;

*Modern physics = quantum mechanics, electrodynamics, astrophysics, solid state physics, nuclear physics, elementary particles and fields

It appears that the work load for undergraduate students is 23-26 hours per week (including laboratories) for a full B.Sc. degree.

The undergraduate curriculum includes an obligatory course "Modern Ideas in Physics" which is given by various members of the faculty and is an introduction to research done in the department, and there is a "Summer Research Program" during which students can work in research laboratories during the summer. In addition, there are elective courses on topics researched by the faculty. Students also take several courses in Jewish studies or other topics from the University at large.

Two new study options are planned for the present academic year:

- **Electrical Engineering and Physics Major (4 years)**
- **Physics Major and Life Sciences Minor**

Undergraduate Teaching Laboratories

The 3rd year Quantum Optics Laboratory was the outstanding laboratory visited. It contained the only experiment (Q-switched laser) in which students started with an empty table and actually set up an experiment by themselves. But this laboratory serves only 8 students per year. The other teaching laboratories visited are not outstanding, and the technical assistance available to them (0.75 technician) is extremely limited. The first year laboratories serve students from other departments (e.g. Chemistry and Optometry Studies) as well as Physics, and the standard is about that of a high school. The Computerized Physics Laboratory includes several experiments with interesting physics, but the computers are limited to collecting data and are not used for control or decision-making. The students required no programming skills to complete this laboratory. The final year Applied Physics Laboratory has some advanced experiments, but the students

do not have the opportunity to set up the experiments themselves or to show initiative since the laboratory is time-shared by interleaving groups of students. Both instruction and equipment maintenance in this laboratory are provided by a permanent staff (two research fellows). The first-year courses in electricity and electronics include laboratory work. Those laboratory facilities are provided by the Engineering Faculty, although the instruction is given by Physics Department TA's.

Graduate Teaching

The M.Sc. research degree requires 13 credit points as well as a thesis, and takes two years. There is also a direct M.Sc. program for exceptional undergraduate students, who are assigned a personal supervisor, and who can achieve the M.Sc. degree in 4 years from the start of their undergraduate studies.

The Ph.D. degree requires a further 8 credit points and four years after the M.Sc. There is also a direct Ph.D. degree, 21 credit points and five years of study after the award of the B.Sc. degree, although this is not generally recommended for students doing experimental work.

Financial Support for Graduate Students

M.Sc. and Ph.D. students all receive scholarships, which limits the number of graduate students in the department. These can be supplemented from research grants and by work as teaching assistants. An M.Sc. student can earn NIS 32-40k per year, and a Ph.D. student NIS 52-60k per year.

Facilities

The Faculty of Exact Sciences as a whole has small machine and electronics workshops, but these are far from adequate, and some experimental researchers have found the need to set up their own shops and to employ the necessary technicians from their research budgets. The faculty also pointed out a serious lack of administrative and secretarial assistance.

Discussions with the Senior Faculty about the Teaching Program

The issues discussed included the limited range of research topics, which inevitably means that some topics that would normally appear in a normal physics curriculum are missing. In the past, complementary courses were occasionally given by outside lecturers, but no such courses are being given at present. There was some concern about the Biophysics Program, particularly since its curriculum structure is at present very loose. The wisdom of having such a course at the undergraduate level should be questioned, because it could lead to a student's not acquiring a deep enough understanding of any of the three disciplines involved (physics, chemistry and biology). The limited number of graduate students was also discussed, but the faculty felt that the number was adequate even if the quality was not good enough in some cases.

Student and Faculty Opinion

The quality of student-staff relations at all levels was found to be excellent, and the "open door" policy of all lecturers was appreciated. Subjects found to be lacking in the curriculum were chemistry and computer programming. In fact, the latter was an indication of poor relations between the Computer Science Department and Physics, emphasized by the fact that Physics courses are not accepted as options by the Computer Science. In general, it is relatively difficult for students to take courses in other departments, above the general studies requirements, and the need to pay extra tuition fees for such courses was seen to be a disincentive to obtaining a university education in the broadest sense.

The graduate students who had studied as undergraduates at Bar Ilan had a low opinion of most of the teaching laboratories, with the exception of the Quantum Optics Laboratory, because of the "cook-book" type of experiments and the poor equipment. They claimed that this was turning prospective students away from experimental research, since they really only learned about experimental physics when they became teaching assistants. The undergraduates supported this opinion.

Undergraduates in the Physics-Mathematics and Physics options compared the mathematics teaching they received. The former, who are taught by mathematicians, felt that their studies were more structured; the latter, while praising the teaching of mathematics by the Physics faculty, claimed that there was considerable variation and gaps between the several courses they received.

One student taking the Biophysics option claimed that it is very difficult because of the range of subjects and different ways of thinking that have to be mastered. He had "discovered" chemistry this way, but found that chemistry students had gained little understanding of basic physics from the one course which they had studied. (This course was not given by a member of the Physics faculty.)

Summary.

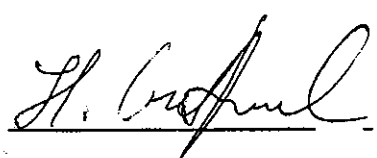
The relatively small size of the Physics Faculty at Bar-Ilan is offset by the limited range of research topics covered, as well as the willingness of the members to accept a heavier teaching load than at other universities. Hiring several new faculty under the new Nanotechnology Center's auspices is in progress. Despite their heavy teaching load, the Faculty should be praised for maintaining excellent relationships with the students as well as carrying out high quality research. However, the lack of courses offered in fields where there is no research carried out in the department means that the scope of subjects that students can study is necessarily limited, and the department should be encouraged to invite external lecturers to give such courses. Also introductory courses in chemistry and computer programming were missing from the undergraduate curriculum, even though applications of computers to physics appear prominently. It was disturbing to hear (as at the Hebrew University) that students taking more than the required number of courses were expected to pay extra tuition fees.

The very restricted administrative limitations and technical assistance that we observed at BIU are not acceptable. The former leads to additional work for an already heavily loaded teaching staff. The latter has a deleterious effect particularly on the first and second year teaching laboratories, which are supported by less than one technician. The teaching laboratories in general were of low standard and strongly criticized by the

students. With such a paucity of technical help, it will not be possible to improve them or to support students in implementing their own initiatives.

Although the Department is proud of offering the only B.Sc. degree in Biophysics in Israel at present, it should be noted that the breadth of the course is apparently accompanied by shallowness, and that the intention of producing students who have a deep understanding of Physics, Chemistry and Biology is therefore not being achieved.

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

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המחלקה לפיסיקה
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Fax: 03-5353298

The Evaluation Committee of The Council for Higher Education site visit

Wednesday, November 15, 2006

Time	Subject	Participants
09:00-09:30	Opening session *Building 202, room 447*	Prof. Joseph Menis (The Rector of Bar-Ilan University) Prof. Kenneth Hochberg (The Dean of The Faculty of Exact Sciences) Prof. Yitzhak Rabin (The Chairman of the Department of Physics) Prof. Leonid Feigel (The Deputy Chairman of the Department of Physics)
09:30-11:30	Meeting with the members of the Program Committee and the Members of the Academic Appointment Committee	**Members of Program Committee** Prof. Benjamin Ehrenberg Prof. Haim Halpern Prof. Lior Klein Dr. Nadav Shnerb **Members of Academic Appointment Committee*** Prof. Richard Berkovits Prof. Michael Rosenbluh
11:30-13:00	Tour of teaching laboratories, meeting with teaching assistants (lab's instructors).	Optics Laboratory Computerized Physics Laboratory Applied Physics Laboratory
13:00-14:00	Lunch *Cafeteria (Building 409)*	Committee members only
14:00-14:45	Meeting with academic staff members	Prof. Mordechai Deutsch Prof. Shlomo Havlin Prof. Richard Berkovits Prof. Yosef Yeshurun Prof. Ido Kanter
14:45-15:45	Meeting with M.Sc. and Ph.D. students	
15:45-16:45	Meeting with B.Sc. students	
16:45-17:30	Closing meeting *Building 202, room 447*	Prof. Joseph Menis (The Rector of Bar-Ilan University) Prof. Kenneth Hochberg (The Dean of The Faculty of Exact Sciences) Prof. Yitzhak Rabin (The Chairman of the Department of Physics) Prof. Leonid Feigel (The Deputy Chairman of the Department of Physics)

*Prof. Moshe Deutsch who is also a member of the Academic Appointment Committee will not particlpate since he is a member in the Evaluation Committee of the Council for Higher Education.