



Committee for the Evaluation of Mechanical Engineering Study Programs

**Ben Gurion University
Department of Mechanical Engineering**

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Chapter 1-Background

The Council for Higher Education (CHE) decided to evaluate study programs in the field of Mechanical Engineering during the academic year 2007-2008.

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

- Prof. William J. Wepfer – School of Mechanical Engineering, Georgia Institute of Technology, USA, Committee Chairman
- Prof. Alexander Solan – Department of Mechanical Engineering (Emeritus), Technion – Israel Institute of Technology
- Prof. Steven Dubowsky – Mechanical Engineering Department, Massachusetts Institute of Technology, USA
- Prof. Mordechai Perl – Mechanical Engineering Department, Ben-Gurion University
- Dr. Joseph Sussman, Vice-President North America Information Technology, Bayer Corporate and Business Services, and President-Elect, ABET, Inc., USA

Ms. Annie-Claire Pilo and Mr. Moty Bar served as coordinators 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 the institutions that provide study programs in Mechanical Engineering and hold on-site visits to those institutions.
2. Present CHE with final reports for the evaluated 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.
4. To recommend standards for the evaluated field of study.

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

The first stage of the quality assessment process consisted of self-evaluation by the institutions. This process was conducted in accordance with CHE Guidelines for Self-Evaluation (December 2006).

Chapter 2-Committee Procedures

The Committee held its first meeting on January 25, 2008 during which it discussed fundamental issues concerning mechanical engineering study programs in Israel and the quality assessment activity of CHE.

The committee members received the self-evaluation reports in January 2008 and the committee conducted two-day visits to each of the institutions offering study programs in the field under examination in March and May 2008. During the visits, the committee met with the relevant officials within the organizational structure of each institution as well as senior and junior academic staff and students.

In order to prevent the appearance of a conflict of interest, committee members did not participate in visits to institutions in which they were faculty members (active or retired). Because Professor Mordechai Perl is a faculty member at Ben Gurion University, he did not participate in this visit. Professor Steven Dubowsky was unable to participate due to a previous professional commitment.

In accordance with the committee's request, the institution publicized in advance the agenda of the committee's upcoming visit and it invited academic staff members, administrative staff and students to meet with the committee in order to determine their opinions of the mechanical engineering study program offered at each of the institutions. This report deals with the Department of Mechanical Engineering at Ben Gurion University. The committee's visit took place on March 18-19, 2008. The schedule of the visit, including a listing of participants representing the institution, is attached as Appendix 2.

The committee thanks the management of the institution and the Department of Mechanical Engineering for their self-evaluation report and for their hospitality towards the committee during its visit.

Chapter 3 - Evaluation of the Department of Mechanical Engineering at Ben Gurion University

Background

The parent unit is the Faculty of Engineering Sciences which was established 1967 under the supervision of the Technion. In the 1970's the faculty became independent with six departments to include the Department of Mechanical Engineering. The Department of Mechanical Engineering offers study programs leading to the B.Sc., M.Sc., and Ph.D. degrees. The Department is comprised of twenty two full-time senior academic staff spanning all major fields of mechanical engineering. Enrollments in 2007 were 588 undergraduates, 35 masters students and 32 doctoral candidates. The Department graduated 172 B.Sc., 10 M.Sc., and 2 Ph.D. degrees in 2007.

Mission of the Program

A condensed version of the Department of Mechanical Engineering's mission statement for its B.Sc. program is given as follows. "The aim of the Department of Mechanical Engineering at Ben Gurion University of the Negev is to promote the practice of mechanical engineering and mechanical engineering sciences in the broadest sense. We promote mechanical engineering first and foremost by training engineers in our B.Sc. program. Naturally, we envision our graduates as leaders in the various activities performed by mechanical engineers: research, development, design, manufacturing, maintenance and management... We choose therefore to concentrate on the best we can accomplish within the time and resources allotted, ergo providing our students with knowledge of the fundamental principles of mechanical engineering and inculcating in them the ability to approach a physical reality as a system, which can be rationally analyzed and understood... Furthermore we hope that emphasizing principles and thought processes will better prepare those students who continue on to graduate research.

The Committee finds that the mission statements of the Faculty of Engineering and the Department of Mechanical Engineering taken together are appropriate for a research university for both undergraduate and graduate programs respectively.

The committee is of the opinion that the senior faculty of the department of mechanical engineering lack an effective strategic vision for their future faculty composition and research directions. Further, the committee believes that a faculty with a well-crafted strategy would significantly enhance its chances for future success.

The Mechanical Engineering senior academic staff believes that it generates significant resources for the university due to both higher enrollments and sponsored research programs. However the academic staff believes that it does not get either the psychological or the financial support it needs. In summary the mechanical engineering program feels that it is not valued by the university.

Ben Gurion University's vision of being a globally competitive research university with a 50/50 mix of undergraduate and graduate students is a good one. However it is not

apparent to the committee how BGU will achieve their objectives given the many constraints that they face.

Study Program

The undergraduate mechanical engineering study program is a traditional one that provides seven tracks of structured electives thereby appearing to provide students with the flexibility to pursue an area of interest. The seven tracks span the breadth of mechanical engineering topics. However the Committee encourages giving the students greater flexibility in allowing students to take elective courses from other engineering departments.

The program includes an excellent “introduction to engineering course” that provides first-year students with the needed exposure to engineering and captures their interest in the field. The laboratory courses and facilities are assessed to be outstanding. The final projects are well-designed and provide the students with an outstanding culminating experience. The Committee encourages even greater use of open-ended assignments to develop a deeper culture of life-long and self learning.

The program has implemented a five-year B.Sc.-M.Sc. program that attracts many of its top students and provides an important source of high-quality students for its graduate program.

The students expressed an interest in having more courses taught in English.

The committee notes, as in programs elsewhere, that cooperation between the engineering programs and the basic science programs could be strengthened.

The committee judges the content and structure of the M.Sc. and Ph.D. programs to be rigorous and appropriate.

Faculty

The mechanical engineering senior staff is outstanding and well-qualified across a healthy spectrum of mechanical engineering. Their research is of very high quality.

The committee was extremely impressed with the junior faculty and believes that this bodes well for the future of the program.

Both senior and junior academic staff are passionate about the success of their students. The excessively high student to faculty ratio is not consistent with Ben Gurion University’s mission and vision of being a globally competitive research university.

The mechanical engineering senior academic staff has struggled and is divided with respect to the issue of faculty hiring. This circumstance appears to be caused collectively by the lack of strategic consensus as to the future direction of the program, a complex and awkward hiring process, and frustration among the senior academic staff that there is nothing that they can do to change things. The committee believes that the senior academic staff must take full responsibility for the future direction of the program.

While the committee is well aware of the external budget constraints, the committee also suggests that the BGU administration provide “bridge” funding for new faculty lines to mechanical engineering upon receipt of a coherent strategic plan.

Teaching and Learning

The fabric and quality of the mechanical engineering undergraduate program delivery is at great risk due to the increasing student-to-faculty ratio and the large class sizes.

The relatively advanced age of Israeli engineering students and the large number of students that work part-time reinforce the desire of engineering students to be “spoon-fed” with “essential” information and deter them from undertaking self-education programs. Self-education, however, must be an important goal of engineering education, considering the need of practicing engineers to keep pace with the continuous advances in science, technology, and engineering practice. Engineering requires life-long self-education. While the committee finds that the undergraduate study program at BGU does contain some self-study and open-ended problems to nurture the students’ creative skills, the committee feels that BGU should expand the use of open-ended problems and to enhance the students’ creative abilities. Classes should be structured to encourage active learning such as requiring students to use outside materials, and not to depend solely upon the faculty to spoon-feed them. The committee encourages the senior staff to integrate teaching methodologies that promote such “active learning” experiences, especially in the first two years of the curriculum. The committee commends the program for the use of some engineers from industry as instructors and believes that the program could benefit from additional interactions with industry.

Students

The BGU undergraduate students appear to be very competent and well-prepared across a broad spectrum of mechanical engineering. They are dedicated to their studies and are quite optimistic about their futures. The students were extremely complimentary of the mechanical engineering program and key staff members. Virtually all of the undergraduate students have jobs upon graduation.

The graduate students were also impressive and all reported having jobs or job offers before they completed their degrees. Many of the graduate students the committee interviewed were products of the BGU five-year B.Sc.-M.Sc. program. The committee encourages BGU to explore other mechanisms to attract a larger number of graduate students. The committee suggests that the issue of low stipends be addressed.

Research

The research conducted by mechanical engineering academic staff is outstanding as reflected by their publication record. There are visible centers of strength in mechanics and shock waves, particle technology, and energy. The facilities available for experimental research are excellent. The biggest limiting factor for the senior staff is the low number of Ph.D. students available to work on research projects.

Infrastructure

The infrastructure is very impressive and appears to provide for the needs of the faculty and students in both teaching and research. The Library is an excellent resource for students.

The committee notes persistent reports of space shortages and believes that improved space planning with regard to the scheduling of undergraduate courses might help to alleviate some of the perceived workload issues.

Self-Evaluation

The committee was disappointed that the self-evaluation report, written by the chair of the department, did not reveal all of the important issues delineated in the sections above. The self-evaluation report lacked a deep level of introspection. It wasn't clear to the committee that the senior staff embraced the self-study, and the committee did not perceive a commitment on the part of the senior academic staff to take responsibility for the future direction of the program. The committee expects that the senior staff will follow up on the recommendations given in this report.

Summary

The graduates at all degree levels of the School of Mechanical Engineering are very well prepared for professional success in their careers.

Ben Gurion University's vision of being a globally competitive research university with a 50/50 mix of undergraduate and graduate students is a good one. However it is not apparent to the committee how these objectives will be achieved given the many constraints that the institution faces.

The fabric and quality of the mechanical engineering undergraduate program delivery is at great risk due to the increasing student-to-faculty ratio and the large class sizes.

The committee notes that the senior faculty of the department of mechanical engineering lack an effective strategic vision for their future faculty composition and research directions. The mechanical engineering senior academic staff has struggled and is divided with respect to the issue of faculty hiring. This circumstance appears to be caused collectively by the lack of strategic consensus as to the future direction of the program, a complex and awkward hiring process, and frustration among the senior

academic staff that there is nothing that they can do to change things. The committee believes that the senior academic staff must take full responsibility for the future direction of the program. A faculty with a well-crafted strategy significantly enhances its chances for future success and the committee recommends that the BGU mechanical engineering program develop a strategic plan over the next year. While the committee is well aware of the external budget constraints, the committee suggests that the BGU administration provide “bridge” funding for new faculty lines to mechanical engineering upon receipt of a coherent strategic plan.

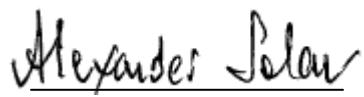
The senior staff needs to continue to examine and monitor the undergraduate study program and take action to include addition open-ended problem solving in the first two years of the undergraduate program. Self-education must be one of the most important goals of engineering education, considering the need of practicing engineers to keep pace with the continuous advances in science, technology, and engineering practice. Engineering requires life-long self-education. The committee finds that the undergraduate study program does not contain enough self-study and open-ended problems to nurture the students’ creative skills. Classes should be structured to encourage active learning. The committee recommends that these curricular and teaching pedagogy issues be addressed within the next two years.

The Committee is aware that all study programs operate under external constraints, in particular budget limitations. Nevertheless, it is the Committee's opinion that many of its recommendations can be implemented within the external constraints, by appropriate action of the authorities of the university and department.

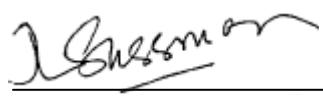
Respectfully submitted,



Prof. William J. Wepfer
Chairperson



Prof. Alexander Solan
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Dr. Joseph Sussman