Committee for the Evaluation of Mechanical Engineering Study Programs

Afeka Tel-Aviv Academic College of Engineering
Department of Mechanical and Systems Engineering

August 2008

Contents

Appendices

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 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 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 as well as 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).

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 and Systems Engineering at Afeka Tel-Aviv Academic College of Engineering. The committee's visit took place on March 12-13, 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 and Systems Engineering for their self-evaluation report and for their hospitality towards the committee during its visit.

Chapter 3 - Evaluation of the Department of Mechanical and Systems Engineering at Afeka Tel Aviv Academic College of Engineering

Background

Afeka College of Engineering was established in 1996 and admitted its first students in the 1996-97 academic year. Afeka is a public, non-profit organization and is supported by the Planning and Budgeting Committee of the Council for Higher Education (CHE). Afeka was accredited to grant a bachelor's degree in 1999 by the CHE. Currently Afeka offers five undergraduate engineering programs leading to a B.Sc. degree, including electrical & electronic engineering; mechanical & systems engineering; software engineering; industrial & management engineering; and medical engineering. Total enrollment at Afeka is roughly 1800 students.

The Department of Mechanical and Systems Engineering was established in 1996. In 1999 the Council for Higher Education accredited the Bachelor of Technology (B.Tech.) program in Mechanical and Systems Engineering and in May 2004, it accredited the B.Sc. degree program which superseded the B.Tech. degree. The program currently offers no graduate-level programs. The program enrolls nearly 500 students and had 62 graduates in 2007.

Mission of the Program

The Department of Mechanical and Systems Engineering's mission statement for its B.Sc.. program *"is to provide a top-tier education program for undergraduate studies in the field of mechanical and systems engineering. Students are educated in applied engineering at high standards. They are introduced to the latest technologies and trained to continue their self-study, in order to enable them to stay updated regarding innovative techniques in this rapidly changing field. Students are introduced to the culture of engineering, team work, clear and professional communication, and globally acceptable ethical codes."*

The committee finds that the mission statement of the Department of Mechanical and Systems Engineering is a proper one for this college. The committee finds that the study program reflects this mission statement.

Study Program

The study program covers topics that are appropriate to mechanical engineering. The committee believes that the study program adequately prepares students for careers as practicing mechanical engineers. It appears that the program is delivered using too many low-point value courses. Delivering the same content using fewer but higher point-value courses may enhance the educational experience and effectiveness of the program. The committee expects that the core mechanical engineering academic staff will obtain full authority for their curriculum within the next two years. However, the committee strongly encourages the core academic staff to take full and immediate responsibility for

their curriculum by engaging in strategic planning for its future direction. A program that has a thoughtful strategic plan enhances it opportunities for future success.

The final projects provide an excellent capstone design experience for the students. The core academic staff must review the depth of coverage in some areas, especially those in the engineering sciences, and adjust the point-values of the courses accordingly. Some of the basic engineering science courses appeared to lack coverage of subject matter.

The availability of advanced electives in both engineering science (such as applied mechanics, structures, fluid mechanics, and advanced dynamics and controls) and professional engineering (such as design, manufacturing, and robotics) is limited.

Faculty

At the time of the committee's visit (March 2008), the committee found that the academic staff was well-qualified to offer the mechanical and systems engineering study program, but the size of the core academic staff identified as mechanical engineering (currently five) was too small and needed to be increased to assure success of the program (the committee suggests that the core faculty grow to eight). While the use of external staff to teach specialized courses is appropriate, Afeka is encouraged to hire core academic staff who can teach a large portion as well as a wide spectrum of the study program.

The committee observed a lack of diversity among the academic staff. For obvious and historical reasons Afeka has close ties to Tel Aviv University, however the committee encourages recruitment of faculty from other Israeli institutions as a means of broadening its intellectual environment. One implication of the department's mission statement is the need for the continual updating of the faculty. A professional development program for core academic staff should be developed. At present, many academic staff maintain currency through research activities.

In June 2008, Afeka College notified the CHE that it had hired three new full-time faculty members in the areas of materials, fluid mechanics, and robotics. The committee hopes that these new hires will redress the situation.

The academic staff perception of expectations for promotion is not aligned with Afeka's mission and goals as articulated by its President. The academic staff believes that successful research is a critical element for advancement. The committee strongly encourages the CHE to develop and promulgate an alternative path for faculty promotion based on professional achievement and demonstrated professional engineering competence. It should be made clear, that given Afeka's mission, continuous professional development activities by the staff are as important as research and should be rewarded.

Teaching and Learning

Afeka College emphasizes teaching quality in its mission statement and appears to have processes in place to assure teaching quality. The Department of Mechanical and Systems Engineering uses students evaluations, peer observation and evaluation by the chair, review of web and course materials and performance on student exams as mechanisms to assure quality teaching. These processes are applied to both the internal core academic staff as well as to the external staff. The committee commends the program for such an effective and systematic approach.

Class sizes are kept small and the academic staff provides significant and meaningful support of their students through extensive office hours. The study program does include some early exposure to engineering which engages student interest and motivates their success. The committee recognizes that the program has begun to include open-ended problems into several of their courses and laboratories. 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. The committee encourages Afeka to continue to enhance and emphasize self-study and open-ended problems to nurture the students' creative skills.

Students

Afeka employs an algorithm based upon test scores and prior academic performance for admission. In addition, Afeka uses an admission committee to review and admit up to 15% of the entering class who fall below the published admission threshold. The program appears to appropriately track the academic progress of these students and the visiting committee believes that such a special admission policy falls within Afeka's mission statement.

Afeka carefully tracks the academic progress of their students through-out their study programs and provides appropriate intervention for students who experience difficulty. Afeka also tracks the success of their graduates in industry. Afeka proudly points to their 85% placement of recent graduates in Israeli industry.

Students expressed a high-level of satisfaction with their study program. The students are pleased with the small class sizes and the highly-personalized attention they receive from the academic staff. They also appreciate the flexible class scheduling that allows them to blend work, family, and school obligations. The committee found the students to be very capable and optimistic about their future prospects.

Research

Since research is not explicitly listed within Afeka's mission and vision statement, the committee did not review and evaluate the research component and offers no judgments in the area.

Infrastructure

Afeka College is housed in two modern buildings that provide classroom, laboratory and office space. The environment is very pleasant, but given recent and planned growth, it lacks the necessary space for its academic staff and student body. The laboratory space is of very high quality but is overcrowded. The Library is adequate except that it lacks study areas for students. Inadequate office space makes it difficult for the external teaching staff to provide as many office hours as they would like.

Self-Evaluation

The self-evaluation study was prepared by the chair of the department with some input from the core academic faculty. The committee was concerned that the faculty was not fully engaged in the self-evaluation process.

The committee was pleased that Afeka has implemented an effective student tracking system. However the committee was disappointed that the self-evaluation report did not reveal all of the important issues delineated in the sections above, especially that of the faculty expectation for research. The committee expects that Afeka College and the CHE will follow up on the recommendations given in this report.

Summary

The committee finds that the Department of Mechanical and Systems Engineering is preparing its students for successful careers as practicing mechanical engineers in Israeli industry.

The committee recommends that the availability of advanced electives in both engineering science (such as applied mechanics, structures, fluid mechanics, and advanced dynamics and controls) and professional engineering (such as design, manufacturing, and robotics) be increased. These electives should be made available as the number of senior academic faculty is increased (see below).

The committee applauds the college's recent hiring of three additional full-time faculty members. The committee is pleased that these hires reflect a broader intellectual diversity and that the new hires are capable of teaching a large fraction as well as a broad spectrum of the study program.

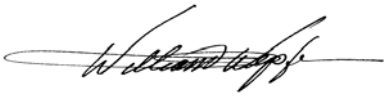
The academic staff perception of expectations for promotion is not aligned with Afeka's mission and goals as articulated by its President. The academic staff believes that

successful research is a critical element for advancement. The committee strongly encourages the CHE to develop and promulgate an alternative path for faculty promotion based on professional achievement and demonstrated professional engineering competence. It should be made clear, that given Afeka's mission, continuous professional development activities by the staff are as important as research and should be rewarded. The CHE should develop and implement an alternative pathway for faculty promotion within the next two years.

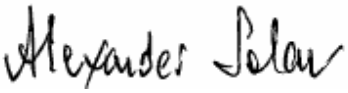
The study program does include some early exposure to engineering which engages student interest and motivates their success. The committee recognizes that the program has begun to include open-ended problems into several of their courses and laboratories. Self-education, however, must be an important 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. Within the next two years, Afeka should enhance and emphasize self-study and open-ended problems within the curriculum to nurture the students' creative skills.

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 college and department.

Respectfully submitted,

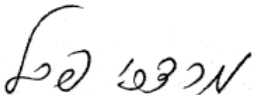


Prof. William J. Wepfer
Chairperson

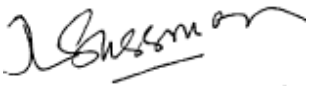


Prof. Alexander Solan
Co-Chair

Prof. Steven Dubowsky



Prof. Mordechai Perl



Dr. Joseph Sussman