Committee for the Evaluation of Mechanical Engineering Study Programs

The Academic College of Judea and Samaria
Department of Mechanical Engineering-Mechatronics

August 2008

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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 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 Engineering-Mechatronics at the Academic College of Judea and Samaria. The committee's visit took place on March 16-17, 2008. Professor Steven Dubowsky was unable to participate in this visit due to a previous professional commitment. 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-Mechatronics for their self-evaluation report and for their hospitality towards the committee during its visit.

Chapter 3-Evaluation of the Department of Mechanical Engineering-Mechatronics at the Academic College of Judea and Samaria

Background

The Academic College of Judea and Samaria was established in 1982 as a college in Kedumim. Its academic history began as an extension of the Bar-Ilan University in 1990 with the move to the Industrial Park in Ariel, where a rapid expansion of the College's programs took place. In 1992, Electrical and Electronics Engineering and Chemical and Biochemical Engineering were established as independent academic departments. In 1996, the Council for Higher Education (CHE) accredited the College, giving it the authority to award academic degrees in its own name. Until 2001 The Academic College of Judea and Samaria accepted students from the Bar-Ilan University degree program. As of 2006, all of the study and degree programs at the Academic College of Judea and Samaria are independent and are under the sole direction of the college. None are under the supervision of Bar-Ilan University.

The Department of Mechanical Engineering-Mechatronics was established in 2002 and was authorized (in 2002) by the CHE to enroll students in mechanical engineering-mechatronics. The program focuses on the engineering of mechanical systems and the synergetic integration of mechanical design, control, electronics and software. The first class began studies in 2003. The program was accredited in 2007 by the CHE. The program currently enrolls 168 students and had 22 graduates in 2007.

Mission of the Program

The mission of The Academic College of Judea and Samaria is based upon the goals of the founders to establish a higher education institution, dedicated to academic excellence in teaching, in fields relevant to the Israeli economy and society, and to initiating applied research activities toward the development of hi-tech industries. Specific goals include:

1. Provide academic education in applied disciplines that will contribute to the Israeli economy;
2. Provide a "second chance" to students who did not receive a quality high school education;
3. Develop research infrastructure for the high-tech industry. The policy of establishing new departments that are tangential to existing departments, and having faculty members teach in several departments, allows the institution to develop inter-disciplinary teaching programs and research teams;
4. Establish graduate degree programs to meet the increasing demand by hi-tech industries for professionals holding gradate degrees, and supporting advanced research by the faculty to keep up with rapid changes in their respective fields.

The philosophy that underlies The Academic College of Judea and Samaria is influenced by the desire to function as a university, while taking into consideration the heavy teaching load of the faculty and the lack of research funding.

"The goals of the program are rooted in the vision that the time has come for the mechanical engineer to join the information age, and in the desire to advance the local robotics industry. The "information age" mechanical engineer engages in the development of smart mechanical systems that combine software and hardware. The objectives of the program are therefore to educate mechanical engineers with a solid background in basic and engineering sciences, and a broad knowledge of mechanical engineering, electronics, and computer science. The graduating engineer should be able to combine theory and practice, be creative, and have oral and written communication skills, both in Hebrew and in English. Since this is the first program in Israel to focus on mechatronics, an additional objective of the program is to establish mechatronics as a viable engineering field in the industry."

The committee believes that the mission of the department is clear and distinctive and is in alignment with the mission of the college. However, any ability to conduct research is challenged by high teaching loads, lack of graduate students, minimal research infrastructure and limited funding opportunities. The committee believes that it is critical that the program have a strategic plan to guide development.

Study Program

The committee notes the ambiguity with regard to the program of study and its title and is concerned about the extent of coverage of mechanical engineering topics other than mechatronics. As the program evolves it will have to address this issue, especially if it creates other tracks that are core to mechanical engineering and tangential to mechatronics.

While narrowly focused, the study program covers topics that are appropriate to mechanical engineering with an emphasis on mechanical systems, electronics, and software. The committee judges that the study program prepares students for successful engineering careers in Israeli industry.

The study program has been carefully designed and integrates important topics from mechanical systems, electronics, and software. This is especially evident in the laboratory course sequence which engages students in a number of integrative exercises. Due to the integrated nature of the program, there is not a lot of flexibility for students to choose electives. The committee notes that some of the traditional engineering science courses may lack scope and depth of content. The committee recommends that the program include a course that explicitly introduces students to engineering and mechatronics during their first year. The final projects are outstanding capstone experiences that expose students to relevant engineering problems that require both design and building of prototype devices.

The chair of the program has provided visionary leadership in the design and development of the study program. The committee strongly encourages the program to develop a culture of academic staff governance of the curriculum. The committee observes promising signs that this is starting to occur.

Faculty

The academic staff is well-qualified to offer the mechanical engineering-mechatronics study program. The credentials of the academic staff are appropriate. The chair of the program provides dynamic and inspirational leadership. The committee applauds the chair's accomplishments but is concerned that the department may be critically dependent upon his leadership. The committee recommends that the junior academic staff be mentored and encouraged to assume additional leadership responsibilities.

Due to the nature of the engineering faculty, it is not always apparent who is included among the core academic staff responsible for the study program. In some cases core academic staff members with 50%-time appointments are intellectually active in the governance of the department. In other cases, staff members with partial teaching appointments, have minimal involvement with the department. The core faculty appears to consist of seven staff. The committee believes that this is not sufficient. The committee believes that another senior academic staff member is needed.
The research accomplishments of the academic staff appear to be extensions of their previous work.

The program uses few external academic staff since they are able to draw on academic staff from other departments of the college. The program's educational environment would be enhanced by greater involvement of qualified industry engineers as external academic staff to teach elective courses.

Teaching and Learning

The academic staff takes their teaching responsibilities very seriously. The college requires its academic staff to participate in seminars and workshops to improve their teaching craft. The Department of Mechanical Engineering-Mechatronics relies on student evaluations to assess teaching effectiveness. The committee encourages the program to also include peer observation and evaluation by the chair, review of web and course materials and performance on student exams as additional mechanisms to assure quality teaching.

Class sizes are kept small and the academic staff provides significant and meaningful support of their students through extensive office hours. The study program would greatly benefit through the inclusion of a first year course that exposes students to engineering and mechatronics.

The committee recognizes that the program has begun to include open-ended problems in the laboratories. However, the program's lecture courses are very traditional and do not appear to include open-ended problems or to stress self-learning. 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 the department to continue to enhance and emphasize self-study and open-ended problems to nurture the students' creative skills.

Students

The visiting committee met with a group of recent graduates as well as with a group of students representing all four years of study. Both graduates and students expressed a high-level of satisfaction with their study program. Graduates of this program appear to be in great demand by Israeli industry. Most students accept employment before they finish the program. The students and graduates are very optimistic about their future. Students expressed gratitude for the small class sizes and the personal attention they receive from the academic staff.

The program uses an algorithm for the admission of students that is based upon standardized test scores as well as high school performance. Up to 10% of the class may be admitted as special admissions based on careful review of their credentials. The program attracts students from many areas in central Israel. Since its inception the program has attracted a larger applicant pool due to the employability of its graduates and its growing reputation. The committee applauds the program for raising its standards in response to a growing applicant pool.

The committee was impressed that the academic staff that teaches math and science indicated that the mechanical engineering-mechatronics students were among the best students at the college.

Research

The quality of the research as reflected by the academic staff's publication record is appropriate, though a significant fraction is an extension of previous work. The committee is mindful of the large teaching loads and the apparent conflict with the expectation for research productivity. The committee is concerned that the academic staff will not be able to sustain their current research productivity given the large teaching loads.

Infrastructure

The infrastructure is appropriate for the current needs of the program. The environment is generally pleasing and conducive to learning. Some of the "space allocation" issues cited in the self-study were not observed by the committee. The library is acceptable and the committee notes that a new library is under construction. Students expressed some frustration with the lack of space for group study. The committee notes that the infrastructure will need to be enhanced if the college's goals for research are to be fulfilled.

Self-Evaluation

The self-evaluation study was prepared by the chair of the department with some input from the core academic faculty. The committee notes that the department did conduct a retreat to discuss issues relevant to the self-study. The committee encourages the program to enhance its internal assessment of teaching and expects that the college will follow up on the recommendations given in this report. The committee is pleased that the department appears to have the full support of the college administration.

Summary

The committee finds that the graduates of the Department of Mechanical Engineering-Mechatronics are prepared for successful careers as practicing engineers in Israeli industry.

The committee believes that one more senior academic staff member is needed. The committee recommends that this increase occur within the near term. The committee believes that identification of the core academic staff needs to be made more visible. The committee recommends that the junior academic staff be mentored and encouraged to assume additional leadership responsibilities. The program's educational environment would be enhanced by greater involvement of qualified industry engineers as external academic staff to teach elective courses.

The ability to conduct research is challenged by high teaching loads, lack of graduate students, minimal research infrastructure and limited funding opportunities. The committee believes that it is critical that the program have a strategic plan to guide development. The committee recommends that this strategic plan be formulated within the next year.

The study program would greatly benefit through the inclusion of a first year course that exposes student to engineering and mechatronics. The committee recognizes that the program has begun to include some open-ended problems their laboratories. However, the program's lecture courses are very traditional and do not appear to include open-ended problems or to stress self-learning. Self-education, however, 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 encourages the department to continue to enhance and emphasize self-study and open-ended problems to nurture the students' creative skills. These curricular and pedagogical issues should 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 college and department.

Respectfully submitted,

Prof. William J. Wepfer Chairperson	Prof. Alexander Solan Co-Chair
Prof. Mordechai Perl	Dr. Joseph Sussman