

Response to the Recommendations of the CHE's Evaluation Report On Mechanical Engineering Study Programs in the Technion

The ME team is grateful to the Evaluation Committee for a thorough evaluation of the Faculty activity and standing, and also for providing useful feedback for further progress and improvement. The recommendations were discussed among the faculty members and the responses are summarized below.

Mission of the Program

“The committee also observed that the Faculty of ME lacks a strategic plan...” The ME Faculty is acting towards implementation of its academic development goals, as summarized in the Evaluation report. The specific faculty academic development steps are contemplated in the Report of the Faculty Committee for Academic Development submitted in March 2008 to the Faculty Dean as per the recommendations of the ME Faculty International Evaluation Committee in its report of 2007. The Report of the Faculty Committee for Academic Development is being discussed among the Faculty members, and upon approval will constitute the basis of the Strategic plan for fulfilling the ME Faculty mission and attaining the specific goals. This Report was not brought to the attention of the Evaluation Committee because it had not yet been approved by the Faculty Council.

Study Program

- *“The Committee encourages Technion to consider a more flexible approach that would allow students to declare engineering major after their first year ...”* The ME Faculty is ready to cooperate in modifying its engineering teaching program to allow for some flexibility in declaring the engineering major.

- *“Enrollment in the doctoral program is lower than desirable...”* The ME Faculty acknowledges that the current Faculty enrollment in the doctoral program is insufficient for carrying on high-quality competitive research and providing an adequate junior teaching team. The Faculty experiences difficulties in attracting excellent, high quality BSc graduates to join the graduate education programs, which would help the Faculty achieve its needs and mission. The reasons for the above are (i) extremely attractive and numerous industrial employment possibilities existing in Israel and abroad for Technion’s ME graduates; (ii) comparatively (to industry) low financial support available for PhD students; (iii) heavy teaching loads and poor payment offered to the graduate students, employed as teaching assistants. In spite of the above factors, increasing graduate and especially PhD students’ enrollment is one of the Faculty’s administration's highest concerns, as also specified in the proposed faculty strategic development plan.

- *“Some of the laboratory equipment data is outdated...”* see below Infrastructure

Faculty

- *“... limited operating budgets threaten ... threaten the progress of such junior faculty members once the start-up equipment becomes obsolete”* Recruiting and absorbing excellent faculty members are the Faculty's uppermost priority, as per the prospective strategic development plan. The Faculty and the Technion's administration are acting to secure the necessary resources for continuous support of the untenured junior Faculty members at least during the first several years of their employment beyond the start-up package. The Faculty current operating budget is inadequate for this task. The Faculty administration maintains that the competitive start-up packages are absolutely crucial for attracting excellent new Faculty members.

- *“...it is crucial (to) ... place a high priority on the recruitment of women faculty”* The ME Faculty ability to recruit women faculty is handicapped by the traditional image of the ME discipline that does not encourage women to enroll in the undergraduate program. This produces a limited number of potential female faculty members. The ME Faculty and its Public Relation Committee are acting towards changing the image of the ME field to emphasize its interdisciplinary nature, and new emerging areas, such as bio-mechanics, bio-robotics, MEMS, opto-mechanics, etc. This is done by promoting pre-academic high-school student tutoring in Robotics, lecturing in high-schools by the junior Faculty members and cooperating with the IDF-operated pre-army university education enrollment programs (Brakim).

- *“...budget cuts have reduced the size of the full-time faculty from 48 to 36 the external faculty teach nearly 50% of the ... course offering... This reliance on the external faculty may have a long-term detrimental impact on the quality and consistency of the student's educational experience”* The ME Faculty agrees that the significant cut in the number of full-time faculty members, which occurred concurrently with sharp increase with undergraduate and graduate students' enrollment, negatively affected the quality of education offered. Currently the ME Faculty experiences difficulties in hiring outstanding new faculty members especially in such areas as energy research, ME design and manufacturing, where the Faculty is subject to tough competition with industry and academia. Absorption and promotion of young faculty members in the two latter areas require Technion committees to broaden the scope of their evaluation criteria. In addition limited research grant opportunities in ME in Israel constitute the major factor discouraging researchers to pursue academic careers in Israel in this field and underlying the decision of several senior ME Faculty members to leave the Technion and join foreign universities.

The ME Faculty fully agrees with the Evaluation Committee that the current shortage of the full-time faculty members is a major handicap affecting the quality and consistency of the undergraduate engineering teaching, as is currently offered. Attracting qualified senior external (adjunct) teaching staff is very difficult, being impeded by the inadequate compensation offered. ME Faculty members and the administration are striving to minimize the effect of these factors and are hoping to cooperate with the Technion's administration to find ways to compensate for lack of resources.

Teaching and learning.

- *“The committee encourages the faculty to continue to nurture .. (self education)...among Technion mechanical engineering students”*. The ME Faculty members are encouraging and fostering self-learning in undergraduate and graduate engineering education. In parallel the Faculty is prepared to extend help in cultivating self-learning skills among those undergraduate students who have difficulties in keeping pace with the program. Continuous raising of admission criteria will help the ME Faculty to achieve progress in this task. This activity is envisioned within the Faculty’s prospective strategic development plan. Lack of quality teaching assistants and limited employment budget make it difficult to exercise efficient teaching in small groups (as is carried out in leading universities) and nurturing of self-learning skills.

“Low stipends for external faculty and teaching assistants make it extremely difficult to attract such individuals to teach courses”. The Faculty administration is facing this problem in its full gravity and currently acting to involve several industrial companies, interested in contributing to teaching. In parallel the Faculty is hoping to receive an employment budget adequate for sustaining quality teaching.

Students

“...doctoral students indicated that there was not consistent mentoring of students to pursue academic careers”. The ME Faculty members devote much effort in such mentoring both on the undergraduate and graduate levels, however face tough competition with the Israeli industry, which offers extremely attractive employment opportunities for ME students prior to their graduation (during 3rd and 4th years).

Research

“Doctoral students expressed frustration that much of their time was spent in as teaching assistants. ... The committee encourages to explore alternative methods of funding graduate students so that more of their time could be devoted to research”. Insufficient numbers of graduate students involved in teaching cause heavy teaching loads. On the other hand limited funds available for stipends and adjunct teachers do not encourage students to enroll in graduate studies in numbers that would allow alleviating their teaching assignments. All this makes it difficult to improve the current situation in PhD students’ research. The Faculty administration is acting to enhance student enrollment in graduate studies through the Re'amim program, which envisions in particular direct study towards the PhD degree. In parallel, Technion and Faculty administrations act to secure external funds to make up for the monetary gap between the graduate stipends available and salaries offered to ME graduates in the labor market.

Infrastructure

- *“ ...some of the laboratories appear to be somewhat dated and could use a major upgrading”*. The ME Faculty acknowledges that some of the Faculty undergraduate laboratory experimental basis is dated and should be renewed to improve the quality of teaching and students’ motivation and involvement in experimental engineering education. The Faculty is happy to report that funds have been secured by the Technion

for a new ME building which will house and equip modern teaching laboratories as well as other facilities.

Meanwhile, the Faculty is currently offering 11 undergraduate laboratory courses and numerous projects in experimental education involving sophisticated infrastructure, instrumentation and equipment. Efficient teaching of these laboratory courses, maintenance and continuous renewal of the laboratory experimental basis, require a significant operating budget, qualified technical manpower and adequate management structure. The ME Faculty is currently lacking much of the above resources. The Faculty administration is acting to secure the requisite funds for renewing some of the equipment, hiring appropriate teaching staff, re-training technicians and re-structuring the existing manpower management system to attain the above educational goals. In particular, the Faculty is now allocating some of the funds available for establishing a new undergraduate teaching laboratory for Renewable Energy Systems.

- *“...the department’s computer clusters included very old systems and lacked the server-centric site-license access to modern engineering software...”* The ME Faculty studied in depth the recommendations of the Evaluation Committee about computer service infrastructure. The Faculty maintains that the server centric site license access to software, as suggested, is implemented in the students’ computer Farm in accordance with the rules and practices accepted and used in the Technion. The existing Faculty Computer Farm organization accords with the educational goals and the teaching program, although the computer clusters used include several old systems. The Computer Farm requires constant upgrading with ensuing extensive expenditures, which are inconsistent with the Faculty’s operating budget. The Faculty administration is currently acting to secure funds towards replacing many outdated systems in the Computer Farm and to enlarge and re-organize its existing computer drawing classroom. We also acknowledge that the existing Faculty computer communication infrastructure is outdated and should be upgraded before long. The Faculty operating budget is inadequate for this task.

- *“...the students used library for studying and working in groups and that the operating hours did not accommodate the student needs. ... the committee questions the efficacy of operating numerous satellite libraries in a resource constrained environment”* . Both ME Faculty members and students maintain that the Faculty library accessible during the day and the evening, is very instrumental both in providing space and fostering the students’ self-education and providing convenient access to the material and information, necessary for sustaining faculty teaching, supervising and research activities. The ME Faculty therefore is convinced and confident that the library facilities and operating hours are appropriate for the needs of both faculty members and students. On the other hand, the ME Faculty is willing to cooperate with Technion’s administration and other faculties on possibilities of creating and using more centralized library facilities, provided they are adequate for the ME Faculty needs.

Self-evaluation

- *“... the self-study did not provide in depth introspection in terms of where (the Faculty) is and where it wants to go. ... The committee encourages ... to develop a strategic*

plan...” The Faculty Dean and members are cooperating towards finalizing and implementing the Faculty strategic plan, while being fully aware of the Faculty’s current position and understanding its mission and goals. Cooperation with the Technion’s administration is a necessary prerequisite for managing and increasing the Faculty budget, which is now inconsistent with carrying out the Faculty’s mission, attaining its goals and maintaining its position as the leading ME Department in Israel, responsible for educating the major portion of Israeli Mechanical Engineers.

Summary

“The committee encourages mechanical engineering to expand its undergraduate curricular offerings through collaboration with other Technion departments”. The ME Faculty together with the Technion’s administration are taking all possible steps to advance implementation of the proposed interdisciplinary track in Biomechanical Engineering. In addition, the ME undergraduate curricular includes close to 40 advanced courses in various branches adjacent to ME, including materials, civil, environmental chemical and aeronautical engineering, that are delivered in collaboration with other Technion faculties. Among other steps towards implementing the recommendations of the Evaluation Committee are partnership of ME Faculty in Technion’s Autonomous Vehicles Center and extensive participation in several interdisciplinary programs for MSc studies developed jointly with other Faculties, including System Engineering, and a new Automotive Engineering program, which is currently being developed in collaboration with the Faculty of Civil and Environmental Engineering. Both programs include courses open to undergraduate students and delivered by several Faculties.

Innovative and Life-Long Learning

“The committee believes that each of the six programs must modify their curricula to put an even greater emphasis (on) open- ended learning experiences”. The ME Faculty agrees and will consider implementing this recommendation.