



DEPARTMENT OF MECHANICAL
ENGINEERING
BEN-GURION UNIVERSITY OF THE NEGEV

EVALUATION REPORT

COMMITTEE FOR THE EVALUATION OF MECHANICAL ENGINEERING STUDY
PROGRAMS IN ISRAEL

JUNE 25, 2018

Section 1: Background and Procedures

- 1.1** In the academic year 2017-18 the Council for Higher Education [CHE] put in place arrangements for the evaluation of study programs in the field of Mechanical Engineering [ME] in Israel.
- 1.2** The Higher Education Institutions [HEIs] participating in the evaluation process were:
- Afeka Academic College of Engineering
 - Ariel University
 - Ben-Gurion University
 - Ort Braude Academic College of Engineering
 - Shamoon Academic College of Engineering
 - Technion – Israel Institute of Technology
 - Tel Aviv University
- 1.3** To undertake the evaluation, the Vice Chair of the CHE appointed a Committee consisting of¹:
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|---------------------------------------|--|
| • Prof. David Norris, Committee Chair | ETH Zurich, Switzerland |
| • Prof. Leslie Banks-Sills | Tel Aviv University, Israel |
| • Prof. Patricia Brackin | Rose-Hulman Institute of Technology, USA (ABET representative) |
| • Prof. David Clarke | Harvard, USA |
| • Prof. Kon-Well Wang | University of Michigan, USA |
| • Prof. William Wepfer | Georgia Tech, USA |
- Ms. Maria Levinson-Or served as the Coordinator of the Committee on behalf of the CHE.
- 1.4** The evaluation process was conducted in accordance with the CHE's Guidelines for Self-Evaluation (June 2017). Within this framework the evaluation committee was required to:
- examine the self-evaluation reports submitted by the institutions that provide study programs in ME
 - conduct on-site visits at those institutions participating in the evaluation process
 - submit to the CHE an individual report on each of the academic units and study programs participating in the evaluation
 - set out the Committee's findings and recommendations for each study program
 - submit to the CHE a general report regarding the evaluated field of study within the Israeli system of higher education including recommendations for standards in the evaluated field of study

¹The Committee's letter of appointment is attached as **Appendix 1**.

- 1.5 The evaluation committee examined only the evidence provided by each participating institution — considering this alongside the distinctive mission set out by each institution in terms of its own aims and objectives. This material was further elaborated and explained in discussions with senior management, lecturers, students, and alumni during the course of each one-day visit to each of the institutions.²
- 1.6 This report deals with the Department of Mechanical Engineering at **Ben-Gurion University**. The Committee's visit to the university took place on June 24th, 2018. The schedule of the visit is attached as **Appendix 2**.
- 1.7 The Committee thanks the management of Ben-Gurion University and the Department of Mechanical Engineering for their self-evaluation report and their hospitality towards the Committee during its visit to the college.
- 1.8 N.B. this report will use Faculty, with a capitalized first letter to refer to the Faculty of Engineering Sciences and will use faculty with the first letter not capitalized to denote professors and lecturers of the ME Department collectively. This report will use Committee, with a capitalized first letter to refer to the international evaluation committee conducting this review.

Section 2: Executive Summary

Aspects of the program related to the vision, QA process, study program, teaching, faculty, research, students, and infrastructure met the acceptable threshold level of performance. Aspects related to the management and administration did not. In particular, the Senior Administration should improve communication and transparency with the faculty. BGU has the potential to exploit many changes occurring in the south of Israel. The Faculty of Engineering Sciences will play a critical role. However, effective leadership is required to build consensus in the faculty, including in the Department of Mechanical Engineering, and move in the right direction.

Section 3: Observations

3.1 Introduction

Ben-Gurion University (BGU) is a research university with approximately 5800 students in its 11 engineering departments. The Department of Mechanical Engineering educates ~760 students for Israeli industry and academia. It is well integrated and supported by the central administration at BGU. The Committee was confident that the School is capable of sustaining and enhancing the ME program.

² Prof. Leslie Banks-Sills did not participate in the visit to Tel-Aviv University or in the panel's discussions concerning the evaluation of this institution

3.2 Management and Administration

The leadership of Ben-Gurion University is generally supportive of the Department of Mechanical Engineering. The Dean of the Faculty of Engineering is strongly supportive of the Department. However, the Committee observed a lack of effective communication between faculty and various levels of the administrative team. The Committee encourages all stakeholders to engage in effective and transparent communication.

The Committee was unable to discern the true extent of departmental decision-making and budget autonomy. However, the program has a well-established committee structure and all faculty appear to be fully integrated into the academic decision-making process, especially with respect to curricular issues. Faculty indicated that their voices are heard at the Department level.

The Department's short-term plan is to fill their open faculty slots, bringing the faculty size to 25. The Department has had difficulty identifying top-level candidates. However, it has placed at least four recent Ph.D. graduates in postdocs at reputable US institutions with hopes to recruit them back to BGU.

In terms of diversity, the Department is aware that it has no female faculty and only 13% female undergraduates. (N.B. the female enrollment in the MSc program has reached an impressive 25%.) The Department has outreach programs to engage and recruit female students, but they could do more. At times, the program conveyed a fatalistic attitude about gender diversity. The Committee encourages the Department to redouble its efforts, especially in recruiting female faculty. The program also provides scholarships to students of low socioeconomic background, but they should increase mentoring and non-financial support for these students.

In this area of evaluation, the Committee determined that BGU does not meet the acceptable threshold level of performance.

3.3 Vision

The Department has a strategic plan which seeks excellence in teaching, excellence in research, and stronger connections to industry. The self-evaluation report listed several implementation steps toward fulfilling the strategic plan. The Department is encouraged to refine and document its plan.

In this area of evaluation, the Committee determined that BGU meets the acceptable threshold level of performance.

3.4 QA & Self-Evaluation Process

The Department thoroughly addressed the previous evaluation from 2008, particularly on curricular issues. Preparation for the current self-evaluation was initiated by the former and present Department Head. The Head created six teams: (1) study programs, (2) teaching, (3) students, (4) human resources, (5)

research, and (6) infrastructure. Special questionnaires were developed and sent to all faculty. The process concluded with an extensive meeting with the Vice-Rector and Dean of Engineering. The strengths, weaknesses, and future steps were then outlined. The various parts of the report were integrated and finally approved by the Dean of Engineering and the Vice-Rector. The Head will work with the appropriate university units to address problems outside the jurisdiction of the Department. In general, the QA process has been driven by the Department rather than the central administration.

In this area of evaluation, the Committee determined that BGU meets the acceptable threshold level of performance.

3.5 Study Program

The undergraduate study program was carefully revamped in response to the last evaluation. It now offers considerable flexibility for students. They complete a set of required core courses designated as essential by the Department. Ten specialization tracks are then offered, but none are required. The student can take electives instead if desired, including from other departments. The Committee commends the Department for defining a unique BGU ME program.

The Department also offers several dual degrees with other departments. They have different credit requirements and lengths. While it is too early to judge their success, the dual degree with Materials Engineering (introduced in 2012) has an increasing enrollment. This indicates that it caters to student needs.

The lab courses were well organized, but the Committee sensed that they may be too prescribed. They should be adapted to encourage critical thinking.

In the graduate program, students cannot take more than two courses outside the Department for credit. The Committee felt that additional flexibility is needed to support the increasing multidisciplinary of ME research.

In this area of evaluation, the Committee determined that BGU meets the acceptable threshold level of performance.

3.6 Teaching and Learning

New faculty and teaching assistants (TAs) must attend a teaching workshop. TAs perform their first teaching experience in lab courses. The Department should remain vigilant in monitoring the performance of their TAs. Student surveys are conducted at the end of each course and are taken seriously. Some faculty use different teaching techniques (*e.g.* posting online recordings of the board with a voice-over explaining each step). Faculty are encouraged to continue these approaches and consider additional techniques such as active learning, problem-based learning, and flipped classrooms.

The students appreciate the detailed syllabi prepared by the faculty and use them extensively. *Mechanical Design Project, Engineering Project 1*, and

Engineering Project 2 do not have a syllabus. Different instructors from industry teach the Mechanical Design Project. It was unclear how quality is assured between the different instructors.

The final projects presented to the Committee were not at the level expected for a university. Within each project, the Committee felt that the quantity and quality of the results were lower than at other ME programs in Israel.

The faculty members support the Department and the students. In general, students receive clear assessment criteria; however, in some cases homework solutions are not given. Old exercise and exam solutions should be available.

In this area of evaluation, the Committee determined that BGU meets the acceptable threshold level of performance.

3.7 Faculty

The overall quality of the ME faculty is good for and consistent with being a research university. They publish in quality journals, have good citation records, and are bringing in grants.

The Committee believes that the faculty size is not sufficient. This has resulted in high teaching loads, increased the student-to-faculty ratio, and limited growth in strategic research directions without critical mass. The Department should develop a strong vision and aggressive hiring plan to exploit the slots and other resources available from the Administration. The startup packages for new hires are adequate compared to other schools. Insufficient technical staff is provided to support the ME faculty's research activities, especially compared to BGU colleagues in Natural Sciences.

The ME faculty understand the promotion and tenure guidelines. The University has a structured mentoring program to guide new hires, appointing a colleague to each and allowing them to switch if necessary. The Rector, Dean, and Head are all involved in meeting and guiding the new faculty periodically. The faculty appreciate the current system and are supportive of new hires.

The ME faculty have a good sense of the strategic directions of the Department.

Overall, the climate among the regular faculty is good; the adjunct faculty also felt part of the Department. However, not all policies from the higher administration are clear to the faculty. This leads to frustration regarding various issues, including the distribution of overhead returns and discretionary funds, and the heavy bureaucracy and paperwork.

In this area of evaluation, the Committee determined that BGU meets the acceptable threshold level of performance.

3.8 Research

The goal of the Department's research is "to encourage and promote cutting-edge research."³ Faculty are involved in basic science as well as applied research. Some undergraduates volunteer or work in research labs. Research efforts also involve ~50 M.Sc. (with thesis), 44 Ph.D., and 7 postdoc students.

Research activities are broad, including: (1) biomaterials, (2) engineering systems, (3) composite materials and structures, (4) biomechanics, (5) fluid mechanics, (6) continuum mechanics, (7) control, (8) fracture mechanics, (9) heat and mass transfer, *etc.* Research funding comes from Israeli and international sources. From 2014 to 2016, the department raised over \$8.5 million with 15% from internal funds. National and international collaborations are prevalent.

In this area of evaluation, the Committee determined that BGU clearly meets the expected threshold level of performance.

3.9 Students

The Department has high admission standards, and the quality of the students is high. Students can also enter through a sequence of preparatory classes. BGU allows 2% of the ME class to be admitted with lower scores, typically for diversity purposes. The Department does not have a clear picture of its drop-out rate, but an internal analysis has been initiated. Students find jobs after graduation and typically enter industry or go to graduate school. BGU and the Department should work to maintain contact with its alumni.

In this area of evaluation, the Committee determined that BGU clearly meets the expected threshold level of performance.

3.10 Infrastructure

The ME program currently has adequate research and office space. However, if the open faculty slots are filled, this situation will likely change. The teaching space also appeared adequate. It is expected that the anticipated new BGU campus will enable the Department to obtain more, better-designed space, allowing the faculty to grow in size. The Department's self-evaluation report notes that access to some journals from the library is an issue.

In this area of evaluation, the Committee determined that BGU meets the acceptable threshold level of performance.

³Self-Evaluation Report, p. 92.

Section 4: Recommendations

Essential recommendations:

- The Senior Administration should improve communication and transparency with the faculty.
- The Department should enhance its efforts to fill their open faculty slots, bringing the faculty size to 25.

Important recommendations:

- The Department should continue to work to improve its diversity, particularly at the faculty level.
- The Department should improve the level of the final projects in the undergraduate program.
- The Department should quantify its undergraduate drop-out rate and, if necessary, implement changes in admissions or student supervision to improve.

Desirable recommendations:

- The Department is encouraged to refine and document its strategic plan.
- The Department should consider making available more exercise and exam solutions for the benefit of the students.
- The Department should consider whether their lab courses encourage critical thinking.
- The Department should consider enhancing the connection between the Department and its alumni.
- BGU should improve journal access at the library.

Signed By:



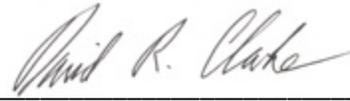
Prof. David Norris
Committee Chair



Prof. Leslie Banks-Sills



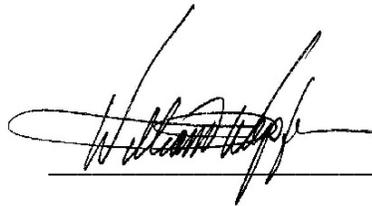
Prof. Patricia (Patsy) Brackin



Prof. David Clarke



Prof. Kon-Well Wang



Prof. William Wepfer

Appendix 1: Letter of Appointment



January 2018

Prof. David Norris
Department of Mechanical and Process Engineering
ETH Zurich
Switzerland

Dear Professor,

The Israeli Council for Higher Education (CHE) strives to ensure the continuing excellence and quality of Israeli higher education through a systematic evaluation process. By engaging upon this mission, the CHE seeks: to enhance and ensure the quality of academic studies, to provide the public with information regarding the quality of study programs in institutions of higher education throughout Israel, and to ensure the continued integration of the Israeli system of higher education in the international academic arena.

As part of this important endeavor we reach out to world renowned academicians to help us meet the challenges that confront the Israeli higher education by accepting our invitation to participate in our international evaluation committees. This process establishes a structure for an ongoing consultative process around the globe on common academic dilemmas and prospects.

I therefore deeply appreciate your willingness to join us in this crucial enterprise.

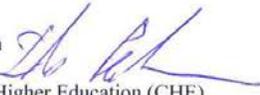
It is with great pleasure that I hereby appoint you to serve as chair of the Council for Higher Education's Committee for the Evaluation of the study programs in **Mechanical Engineering**. In addition to yourself, the composition of the Committee will be as follows: Prof. Leslie Banks Sills, prof. Patricia Brackin, prof. David Clarke, prof. Kon-Well Wang and prof. William Wepfer.

Ms. Maria Levinson-Or will be the coordinator of the Committee.

Details regarding the operation of the committee and its mandate are provided in the enclosed appendix.

I wish you much success in your role as chair of this most important committee.

Sincerely,

Prof. Ido Perlamn 
Vice Chair,
The Council for Higher Education (CHE)

Enclosures: Appendix to the Appointment Letter of Evaluation Committees

cc: Dr. Varda Ben-Shaul, Deputy Director-General for QA, CHE
Ms. Maria Levinson-Or, Committee Coordinator

Appendix 2: Visit Schedule

Sunday, June 24 ,2018		
<u>Mechanical Engineering - Schedule of site visit Ben-Gurion University</u>		
<u>Building: 55 Room: 117</u>		
09:30-10:00	Opening session with the head of the institution	Prof. Zvi Hacoheh – Rector Prof. Gad Rabinowitz – Vice Rector Ms. Adi Zinger – Quality Assessment Coordinator
10:00-10:30	Meeting with the Dean of the Engineering Faculty	Prof. Avi Levy – Dean
10:30-11:30	Meeting with the Head of the ME Department	Prof. Gennady Ziskind – Head
11:30-11:45	Break	Closed-door meeting of the committee
11:45-12:30	Meeting with senior academic staff – tenured and non-tenured*	Dr. Shai Arogeti, Dr. Benny Bar-On, Prof. Kobi Bortman, Prof. Haim Kalman, Prof. Oren Sadot, Prof. Amir Shapiro, Dr. David Zarrouk
12:30-13:15	Meeting with Adjunct academic staff *	Dr. Josef Aharon, Dr. Israel Bronstein, Eng. Shai Cohen, Dr. Mark Dolger, Dr. Ohad Gur
13:15-14:00	Lunch (in the same room)	Closed-door meeting of the committee
14:00-15:15	Tour of facilities: Labs, Final projects presentation	Dr. Israel Bronstein, Prof. Gennady Ziskind
15:15-16:00	Meeting with BSc students**	
16:00-16:45	Meeting with MSc and PhD students**	
16:45-17:30	Meeting with Alumni**	
17:30-17:45	Break	Closed-door meeting of the committee
17:45-18:15	Closing meeting with heads of institution, Dean of the Faculty and the Head of the ME Department	Prof. Gad Rabinowitz, Prof. Avi Levy, Prof. Gennady Ziskind, Ms. Adi Zinger

* The heads of the institution and academic unit or their representatives will not attend these meetings.

** The visit will be conducted in English with the exception of students who may speak in Hebrew and anyone else who feels unable to converse in English.