Introduction to the Graduate Study Program for the Academic Year 2012 - 2013

These explanatory notes briefly describe the teaching and research activities which take place within the framework of the graduate studies at the department of Electrical Engineering. This introduction is intended as additional information to the Academic Regulations for Graduate Students (part of the Technion Studies Catalogue). The purpose of these notes is to guide and prepare the student for the different stages of the study program, as well as to bring to the student’s attention the Department’s special requirements. This booklet contains the list of faculty members and their fields of interest, fields of study, list of courses and a list of theses carried out in the last three years and list of recent publications by Electrical Engineering faculty.

M.Sc. Program:

A student, who has completed his undergraduate studies in Electrical Engineering or Computer Engineering, can be awarded the “M.Sc. in Electrical Engineering” degree, and a student who has completed his undergraduate studies in another discipline can be awarded the “M.Sc. in Sciences” (see admittance). This, after completing 19 credit points of course work and submitting a thesis, on a research, or on an engineering project, or after completion of a study program of 27 credit points of course work and submitting a final paper which amounts to about half the scope of a research or project thesis. A student can be awarded the “M.E.E” (Master of Electrical Engineering—without a thesis), upon completing 40 credit points of course work and undertaking a project or seminar with the framework of “Final seminar 1, 2” – 048990 and 048991.

Two of the credit points must be in one of the basic science courses (see page 42). It is recommended that these credit points are completed prior to the submission of the research proposal. The remaining credit points have to be accrued by studying courses from the list of graduate courses given by the Department of Electrical Engineering as well as from Joint Undergraduate-Graduate courses provided the student did not participate in them during his/her undergraduate studies. The student is allowed to take courses (in addition to the course in basic sciences) offered by other departments. Taking more than one additional such course, however, requires the approval of the Graduate Studies Committee (GSC). This restriction does not apply to the M.E.E. program—see below. The student will be credited for an approved course taken in another department.

The study program (including the research, engineering project, or final paper) has to be structured so as to provide one major area of study and a number of secondary areas.

The student has to submit the study program on the appropriate forms to the Graduate Secretariat of the department of Electrical Engineering.). The forms must be signed by both the student and the advisor. Special requests for an additional course, or for a course cancellation, must be submitted on appropriate forms and signed by both the student and the advisor. All said submissions should be done only through the Graduate Secretariat of the department of Electrical Engineering.

There will be no credit or marks for courses not appearing on study-program forms. It is impossible to cancel a course a posteriori. A student who will not take an exam
in one of his registered courses will be considered failed in this course, unless he has notified the course instructor in advance (or within a week from the exam date). (Note paragraphs 26.03, 26.05, 26.07 in Graduate School Regulations). A re-registration to that course (at a later date) will be required. A qualifying student who is required to take undergraduate or joint undergraduate/graduate courses and failed, can be examined in the second exam period. In case a student fails a graduate course, he will not be entitled to a second exam period.

It is the student's responsibility to find a subject for his/her research/engineering project/final paper proposal (a seminar for Master of Electrical Engineering), as well as to find an academic advisor. The student will approach faculty members in his field of interest (see list of permanent and adjunct members) for this purpose. As a rule, the above mentioned will be accomplished after a student has accrued about 10 credit points (20 credit points in the M.E.E. program). It is not possible to guarantee an advisor for each subject and area: this is especially true for students who do not spend full-time studying at the Technion. Advisor from outside E.E. will be allowed only if a student is unable to find an advisor from within, and after obtaining permission from the Graduate Studies Coordinator. External supervision must be approved by the GSC. The Graduate Studies Secretary will advise the student accordingly.

The final paper, research, and project proposal are the heart of the program, and require significant and concentrated effort, originality and mastery of the scientific area.

The proposal of the research/engineering project/final paper should be submitted to the GSC on a form together with a short explanatory abstract (5-6 lines) regarding the contents of the paper, duly signed by the student and the advisor. As soon as the proposal is approved, the temporary advisor relinquishes his/her post in favor of the final paper, thesis, or project advisor.

A student must make sure that there are active faculty members (not on sabbatical) in his field of interest who might be potential advisors.

**Special regulations for the M.E.E. (Master of Electrical Engineering) Track:**

1. At least 40 credit points accrued from graduate courses.
2. 6 out of the above 40 points must be in seminar courses and/or laboratory including a strong component of independent work. According to the recommendation of the course lecturer and the supervisor, and after the approval of the GSC, the student can fulfill this requirement by taking alternative courses that like the seminar courses and/or laboratory include a strong component of independent work. A course qualifies as “seminar” if it belongs to the 048.../049... groups and, in addition, at least 50% of the grade is based on a paper.
3. According to the recommendation of the supervisor, the student will be allowed to take relevant courses from other departments: Physics, mathematics, computer science and industrial engineering.
4. According to the recommendation of the supervisor and the approval of the GSC, the student can transfer to a Masters program with a thesis if the applicant is found suitable and an appropriate research topic has been defined, or if the independent work develops into work appropriate in scope and depth as a thesis. This is conditional on the agreement of an advisor, from the members of the E.E. department, who agrees to supervise the thesis work. In considering the application, the committee shall consider all achievements by the student up to the time of the request.
5. Prior coursework by an M.E.E. student, done at the Technion or elsewhere (and which is not part of the requirements for another degree) may be approved as part of the requirements, up to a maximum of 24 credit points, of which at most 10 where taken outside the Technion. Following such a request by the student, approval depends on the courses taken and their level. The remaining points will be acquired at the Technion as part of the study program.

6. Graduate students pursuing this program are prohibited from continuing their studies towards a doctoral degree at the department. Continuation of studies towards a Ph.D. degree requires the completion of a research thesis in a category of research work or final paper. M.E.E. graduates may be admitted to the regular M.Sc. program (with a thesis) where their credited graduate courses will be accounted for and only a research thesis (which may be related to their comprehensive seminar) should be completed. If the achievements of the student and the thesis are sufficiently high, a transfer to a direct Ph.D. program may be possible, subject to the regulations of the graduate school and those listed below.

7. An M.E.E. student is not eligible for a stipend.

**Scholarships**

Scholarships application dates appear on the Graduate School website. An M.E.E. student is not eligible for a stipend.
**Admission to the M.Sc. Program:**

Applications to the M.Sc. program are handled by the GSC of the Faculty of Electrical Engineering. The committee considers the potential and the achievements of the candidate, and evaluates his/her chances to successfully complete the program. This is based on all available information, including grades, recommendations, publications, etc. The Grade Point Average serves as a preliminary criterion only. For example, the committee will take into consideration high grades received in advanced and challenging courses. However, it will not take into equal account high grades which are the result of repeating a course several times; this is especially true for basic courses. The student’s willingness to study full-time, without having a job outside the Technion, will be taken into account. The GSC may invite the student for an interview, and / or test his skills in a different way.

**A. M.Sc. in Electrical Engineering**

Applicants with a B.Sc. in Electrical Engineering or Computer Engineering will be considered for the M.Sc. in Electrical Engineering. Candidates must comply with one of the following entry requirements:

1. The candidate has earned a B.Sc. from an Israeli University with a high grade point average (GPA) of at least 88.
2. The candidate has earned a B.Sc. from an Israeli University with GPA of at least 83, was considered and accepted by the GSC (considering supporting material, see the Graduate Secretariat of EE).
3. The candidate satisfies the requirements to transfer from advanced studies (see the relevant regulation below).
4. Student acceptance is conditioned on an interview with faculty members.

Accepted candidates that can not commit to full-time study (i.e. without working outside the Technion) will be accepted to the M.E.E. program. The training of external (i.e. not eligible for a stipend) students will be approved in exceptional cases.

In some cases students will be requested to complete their studies by taking additional courses from the undergraduate curriculum, or courses from the combined (undergraduate and graduate) curriculum, according to the recommendation of the GSC. Such requirements will have to be completed, without failed grades and with a grade point average that will be determined by the GSC. Some of these courses may be credited towards the degree requirements, as per the recommendations of the GSC.

**B. M.Sc. in Sciences**

Applicants with a B.Sc. in the Exact Sciences (i.e., computer science, physics, mathematics), or a B.Sc. in Engineering (excluding electrical and computer engineering) will be considered for the M.Sc. in Sciences. Candidates must comply with one of the following entry requirements:

1. The candidate has a high GPA (at least 90) in his undergraduate studies from an Israeli University.
2. The candidate has earned a B.A. or B.Sc. from an Israeli University with a lower GPA of at least 85, or is a graduate of a recognized university abroad, accepted by the GSC. (With respect to supporting material that needs to be presented to the GSC, please contact the office of graduate studies in the faculty.)

In most cases the candidate will be conditionally admitted as a qualified student and be required to complete courses that will be decided upon by
the GSC. The student must complete these courses without failure, and with a GPA that will be determined by the GSC.

Candidates that are accepted according to case 2 above but cannot commit to full-time study (i.e. without working outside the Technion), will be accepted to the M.E.E. program. The training of external (i.e. not eligible for a stipend) students will be approved in exceptional cases.

**Completion Requirements for M.Sc. in Sciences**

**Completion Requirements for Graduates of a 4 year study-track:**
As a rule, courses from the undergraduate or the combined undergraduate and graduate curriculum that provide background or are basic requirements for the specific fields of interest and according to the GSC’s recommendation. Recognition of courses on the graduate level among these courses as part of the degree requirements is based on the recommendation of the GSC. The GSC will consider the advisor's recommendation regarding this subject as well as previous academic proven excellence of the student.

**Completion Requirements for Graduates of a 3 year study-track:**
As a rule, at least 24 credit points from the undergraduate or the combined undergraduate and graduate curriculum for the specific field of interest, according to that provide background or are basic requirements GSC’s recommendation. The student’s grades must comply with the average grade required for acceptance. Among these courses, at least 24 credits, which will be determined by the GSC, will not be accredited in the Graduate study program. For outstanding candidates, the committee may recommend a reduced requirement of courses.

**C. Admission to the Master in Electrical Engineering track (M.E.E. – without thesis):**
Candidates for the M.E.E. degree should hold a B.Sc. degree in EE or Computer Engineering, or Computer and Software Engineering, or a Bachelor degree in Engineering or Science from the Technion or another accredited University.

Admission Requirements: The candidate should satisfy one of the following conditions:
1. The candidate has a grade point average of 85 or higher in Electrical Engineering, Computer Engineering or Computer and Software Engineering from an Israeli university, or a grade point average of 88 or higher from an Engineering or Science department at the Technion or another accredited University.
2. The candidate has a grade point average of 83 or higher from an Engineering or Science department at an accredited University in Israel or abroad, was considered and accepted by the GSC (concerning supporting material for your application contact the Faculty Graduate Studies Secretary).
3. The candidate satisfies the requirement of transfer from Advanced Studies (see below: admission through achievements in Advanced Studies).

**Pre-requisites for the M.E.E. track**
Pre-requisites for the M.E.E. track are the same as for candidate for the M.Sc. degree.
Completion Requirements for the M.E.E. program.
See completion requirements for M.Sc. in Electrical Engineering.

Graduates of colleges in Engineering or Science:
College graduates in engineering and science can apply only if their college has been accredited by the Israel council for higher education, and was empowered by it to grant the bachelor's degree. For more details please contact the Graduate school.
Each candidate will be examined based on his/her previous studies, their scope and his/her personal achievements. College graduates are required to submit a formal letter stating their ranking relative to other students in the same study program.

Admission to Graduate Studies through Advanced Studies
An applicant whose credentials do not meet the admission requirements for the M.Sc. program may study graduate courses through the Division of Continuing Education and External Studies. This option is available for candidates whose B.Sc. GPA is at least 75.

The applicant will be admitted to graduate studies if:
Completed 4–10 courses, including one course from the list of recommended courses in basic sciences, and the rest graduate level departmental courses, where at least 50% of the courses are combined courses (046... courses), that were not studied as part of the B.Sc. program. Seminar courses, advanced topics in ..., and lab courses are not counted. The student must complete these courses successfully, without failure.

The cumulative GPA of these courses and the undergraduate courses will be calculated as detailed in the sequel.
Admission will be based on the regular conditions for a Masters of Science in Electrical Engineering, where the cumulative GPA replaces the B.Sc. GPA. Recognition of courses that were taken to improve the admission requirements will be in accordance with the recommendation of the GSC.

Cumulative Grade Point Average:
\[ M_w = \frac{n \times M_A + 6 \times M_B}{n + 6} \]

where:
- \( M_w \) – cumulative GPA;
- \( n \) – number of graduate courses completed;
- \( M_A \) – graduate courses GPA;
- \( M_B \) – B.Sc. studies GPA.
Admission to the Ph.D. program:
The candidate is required to find a faculty member of E.E. who is willing to supervise his Ph.D. research. The decision concerning acceptance is made by the Graduate Studies Committee of the department (GSC). Following a recommendation by the proposed supervisor, the GSC shall consider the abilities of the candidate in relation to the Ph.D. program. The committee shall convene several times each year.

The committee considers the potential and the achievements of the candidate, and evaluates his/her chances to successfully complete the program. This is based on achievements in research and in studies, which are evaluated based on publications, recommendations, evaluations of the M.Sc. thesis (if completed), other written material, discussion or oral examination as necessary, and grades throughout the academic career. The GPA is only a preliminary measure. For example, the committee will take into consideration high grades received in advanced and challenging courses.

Direct track towards a Ph.D.

A. This program applies to outstanding students who are studying towards a M.Sc. degree, and whose research may be extended to a Ph.D. The candidate must satisfy the following: (1) during his M.Sc. studies, the student has demonstrated a research ability that clearly attests that he is suitable to enter a Ph.D. program. (2) the student is now within the second semester of the M.Sc. program or later, his research topic was approved, and obtained top-level grades in M.Sc. courses (3) His research topic may be extended to a Ph.D., or become a major part of a Ph.D.

B. Request to be transferred to a direct-Ph.D. track shall be initiated by the advisor, and submitted to the GSC of the Faculty of Electrical Engineering, subject to article 24.07 (direct track towards a Ph.D.) of the regulations of the graduate school.

C. The student will be examined by an ad-hoc committee which will be nominated by the graduate studies committee. The ad-hoc committee shall present its recommendations to the graduate studies committee.

D. If accepted to the direct-track program the student's candidacy examination shall take place within six months of his being notified of acceptance to the track. Upon completing the exam successfully his position shall be changed to a Ph.D. student.

E. A candidate who failed the candidacy examination, or failed to perform the exam within the allocated time, shall continue his studies towards the M.Sc. degree.

Master's Degree for Direct Ph.D. track students
Direct Ph.D. track students will be entitled to a Master's Degree after passing the candidacy exam and completing all course requirements they were obliged to at the beginning of their graduate studies. The title of this degree will be stated as "Magister" in Hebrew (מגיסטר) and "MA" in English to distinguish it from other degrees. The Master's degree certificate will state that the student completed his/her studies towards a Magister during his/her Ph.D. studies.
A special Ph.D. Track:
The aim of this track is to enable particularly excellent B.Sc. graduates who are interested in a direct Ph.D. track, to participate in this route without enrolling to the M.Sc. route. More information for this track is available at the Electrical Engineering Graduate Secretariat.

Ph.D. Program:
A candidate who qualifies with the official requirements of the Graduate School, or who is about to complete his M.Sc. can apply to the GSC stating field of interest. Candidates must find an advisor who is a full-time faculty member. Advisors from other departments will be approved only in exceptional cases. The candidate will appear before the Admission Committee, after approval of a tentative advisor, whose recommendation will be submitted to the GSC. The Committee will consider the candidate's achievements and evaluate his ability orally, or by a written examination. The Admission Committee shall convene several times each year.

A M.Sc. student, who has not yet handed in his thesis to the Graduate school, can apply to the Ph.D. program for the following semester. However, a student will be accepted to the Ph.D. program only after handing in his/her M.Sc. thesis to the graduate school by the end of the semester in which the application was submitted. A student who satisfies this condition will be admitted as a qualified student for one semester and will have to comply with the additional duties required from a student in this status. The committee emphasizes that while a student is in a qualified student status, he is expected to formulate research directions for his Ph.D. and not be occupied with completion of his master's degree.

A M.Sc. student whose admission to a Ph.D. (not direct track) has been conditionally approved prior to completion of his M.Sc. studies, must complete his M.Sc. studies. Final admission is subject to approval of the GSC.

An advisor who is an adjunct faculty member will not be approved unless the GSC has so decided and appointment has been approved by the Departmental Board.

Candidacy Examination
The student should submit a one page abstract to the advisor and to the Electrical Engineering Graduate Secretary one month before the submission of the short description for the candidacy examination, and no later than the beginning of June. This submission initiates the procedure of appointing an examining committee for the candidacy examination.