

Regulations for Master's and Doctoral Studies in the Department of Marine Technologies

Program specifications

There is a myriad of research topics in marine sciences, encompassing diverse fields of knowledge. All share a common challenge—they require the use of advanced, specially-developed engineering methods. In Israel, there are significant knowledge gaps and human resources deficits in engineering research and development related to deep sea exploration technologies. The main goal of the department is to address these gaps by advancing research into innovative marine technologies and by training professionals who can contribute to the establishment, advancement, and innovation of research across various areas of marine science. Graduates of the program will be involved in research and development in academic settings, as well as in the developing marine science industry in Israel and internationally. A further goal of the department is to serve as a national scientific and technological hub for deep sea research expertise and technologies. Training in the department combines expertise in engineering, technology, and marine science, while research focuses on addressing marine research challenges by developing cutting-edge technologies, such as innovations in underwater robotic vehicles, advanced underwater sensors (optical, acoustic, etc.) data processing, communication, and navigation both on and under water.

Language of instruction

The official language of instruction in the department is Hebrew. Proficiency in English at a level suitable for advanced communication is a requirement for admission to the program. Courses in the department will be given in English or Hebrew, at the discretion of the course instructor. If a non-Hebrew speaking student is present on a course, instruction will take place in English.

Admission requirements for the program

Graduates with an undergraduate degree (a four-year BSc) in mechanical engineering, electrical engineering, electro-optics, aeronautics, computer science, and/or in sciences related to these fields from a recognized higher education institution in Israel or abroad, with an average grade of at least 80, may be admitted to the program. Exceptions will be discussed by a departmental committee.

For admission, candidates must submit a CV, a letter of intent, and the names of two referees.

Before commencing study, candidates will be required to contact their potential supervisor (departmental faculty member) and agree on a research topic. The supervisor's formal notification of willingness to supervise the candidate's thesis is a condition for admission to study in the master program.

Supplementary studies

Candidates who graduated with an undergraduate degree in other disciplines, or who do not have the required academic background, may be admitted to the program on a provisional basis, at the discretion of the Departmental Committee for Master's Studies, provided that they fill any gaps in their knowledge by the end of the first year of study, in a manner not to exceed 16 weekly semester hours. Candidates who are required to study supplementary courses amounting to more than 16 weekly semester hours may be admitted to the supplementary year in preparation for submitting a Master's program application. Candidates will be permitted to apply for the Master's program only after successfully completing the required supplementary courses. In principle, the supplementary courses will focus on providing candidates with an adequate background in the following subjects: mathematics (including linear algebra, differential and integral calculus), physics, including mechanics and electricity, programming, and additional complementary courses in line with research requirements.

All supplementary courses will be taught at the accepted academic level of engineering faculties in Israel. The Departmental Committee for Master's Studies will determine the individual supplementary plan for each student according to his or her academic background and research requirements. Candidates must complete the supplementary studies with an average grade of 85 or higher as a condition for continuing their studies in the Master's program.

Target Audience

The target audience of the Master's program is engineering and science graduates aspiring to specialize in marine technologies, and who wish to base their professional activity on in-depth knowledge anchored in a broad academic perspective.

Requirements for admission into the second year of the Master's program

To be admitted into the second year of the Master's program, candidates must pass all their first year regular course units and complete all their assignments with an average grade of at least 80. They must also obtain approval of a proposal for a final research work (thesis) by the end of the summer vacation of the first year.

Conditions for awarding the Master's degree

Degrees will be awarded to graduates of the Master's program in accordance with the graduate studies regulations of the University of Haifa, upon successful completion of courses, submission of a research thesis, its approval (with a minimum grade of 76—the average of all the evaluators' scores) and successfully passing the oral thesis defense examination (with a minimum grade of 76).

The final grade will be constructed as follows:

30% – course grades

35% – final research work (thesis)

35% – oral thesis defense examination.

Distribution of teaching during the academic year

Program studies are spread over the course of about two years (not including supplementary courses). Most of the mandatory courses take place during the first academic year.

The duration of study for the degree is up to three years.

Rationale, goals, and objectives

The curriculum in the Department of Marine Technologies is in Track A, and includes studying subjects in the field and writing a research thesis that incorporates marine-related technological content in order to help develop tools to advance marine research and the content of marine science in general.

The departmental teaching program covers a wide range of topics, including scientific, marine, and technological subjects in a marine context. In addition, students will study experimental methods for marine research, with an emphasis on applying advanced technologies in experimental research. Students will also participate in marine research expeditions, during which they will acquire knowledge in the operation and development of advanced marine technological tools.

Study hours required for the Master's degree

For students who have completed a four-year undergraduate degree in engineering, the scope of the Master's degree course will be 36 credits (including a thesis). For students who have completed an undergraduate degree from another three-year academic background, the scope of the Master's degree course will be 40 credits (including a thesis).

Course content

A combination of mandatory courses, elective courses, and a research thesis, according to the following breakdown:

- **Mandatory courses (divided into two clusters):**
 - Cluster 1: 14 credits. Students should select 7 of the 8 courses from the list below.
 - Cluster 2: Departmental seminar and school seminar—these are mandatory ungraded (pass/fail) courses. Candidates must register for these courses for 4 semesters during their studies.
 - Departmental seminar: for scholarship students—attendance at 70% of the seminars during the semester is mandatory. Full attendance at lectures by external lecturers (around 2 per semester) is mandatory for all students.

- **Elective courses**

Elective courses consist of 10–14 credits (depending on the student's academic background), and are selected according to the following guidelines: Students may choose elective courses from courses listed in the various faculties of the University of Haifa or the Technion, at another university in Israel or abroad (the University of Haifa will handle the payment arrangements), or at the Interuniversity Institute for Marine Sciences in Eilat. Course choices will be made in coordination and agreement with the student's research thesis supervisor(s) and the Chair of the Departmental Committee for Master's Studies.

- **Research work (thesis)**

12 semester hours.

Program structure summary

Year	Mandatory Courses (Semester Hours)	Elective Courses (Semester Hours)	Research Work (Thesis)	Total
1	14	-	-	14
2	-	10–14*	12	22–26
Total	14	10–14*	12	36–40

*14 Semester Hours—for students who have a three-year undergraduate degree

*40 Semester Hours—for students who have a three-year undergraduate degree

Cluster 1: Mandatory courses—select 7/8		
Course	Semester Hours	Lecturer
Principles of Subsea Engineering	2	Prof. Morel Groper
Principles of Underwater Photography and Computer Vision in Marine Research	2	Prof. Tali Treibitz
The Mediterranean Sea 1	2	Dr. Revital Bookman
Underwater Acoustic Signal Processing	2	Prof. Roe Diamant
Geophysical Methods in the Study of the Marine Environment	2	Prof. Yizhaq Makovsky
Navigation and Inertial Sensors	2	Dr. Itzik Klein
Scientific Writing	2	Dr. Beverly Goodman Tschernov
Sailing Course	2	Prof. Roe Diamant
Elective Courses		
Principles of Underwater Vehicles	2	Prof. Morel Groper
Physics-Based Computer Vision in a Diffuse Medium	2	Prof. Tali Treibitz
Advanced Techniques in Signal Processing	2	Prof. Roe Diamant
Processing and Visualization of Seismic Data	2	Prof. Yizhaq Makovsky

Autonomous Submarine Navigation	2	Dr. Itzik Klein
Elective Courses at the School of Marine Sciences		
Practical Workshops in Seismic Data Processing and Analysis	2	Prof. Yizhaq Makovsky
Decoding Seismic Data	2	Prof. Uri Schattner
Numerical Methods in Physics Sequences	2	Dr. Regina Katsman
Physical Oceanography	2	Prof. (Emeritus) Boris Katznelson

Additional elective courses from faculties at other universities (coordinated and agreed upon by the research work supervisor and the Chair of the Departmental Committee).

Choosing a supervisor

Each student must have at least one supervisor (but no more than two) from the academic staff. The maximum number of supervisors permitted is three if one of the supervisors is from outside the department.

Choosing a thesis topic

Students should choose a thesis topic with the approval of their supervisor(s), ensuring that their work matches the department's requirements. The work must be based on one of more of the following research categories: experimental, observational, data analysis, and theoretical research. Students must adhere to a scope of work that can be completed, within two years, including writing the thesis.

Research proposal

By the end of the first year, students will submit a research proposal that complies with the guidelines on the departmental website. The proposal should be written in English. Following submission of the proposal, an evaluation committee will be convened, whose members will include the supervisor(s) and two or three additional members of the department. The evaluation committee will examine the suitability of the proposed research within the criteria of a master's thesis in the department, in terms of both its scientific-academic aspects and its logistical aspects (e.g., time required for completion, availability, financing and equipment, likelihood of success, and so on). The evaluation committee has the authority to approve, reject, or require changes to the research proposal. The approval of the evaluation committee

is required as a condition for the student's continued work. In the event that the evaluation committee requires changes to the research proposal, the student must submit a revised proposal. The evaluation committee will make a decision to accept or reject the revised proposal within two weeks from the date of its submission. In the event that the revised research proposal is rejected, a second committee, which will include the student's supervisor, the head of the department, and the chair of the teaching committee, will be convened and will discuss the continuation of the student's studies in the department.

Writing the thesis and preparing for the viva examination

The thesis should be written in monograph format (standard thesis format) or as an article-based thesis. The choice of format is made by the student and his or her direct supervisor.

If the thesis is submitted as an article-based thesis, approval of the Departmental Master's Degree Committee is required, to which the student should submit a request to submit an article-based thesis. The request should include the name of the professional journal (or 2–3 alternatives), a list of authors (the submitting student should be the first author or first co-author (equal contribution)), an official document from the journal detailing its guidelines for articles (instructions to authors), the type of article to be submitted (e.g. synthesis, research article). The Departmental Committee for Master's Studies will approve submission as an article-based thesis provided the following conditions are met: (1) the journal is a recognized and accepted journal in the field of study in which the article is written. As a rule, this refers to long format articles; (2) the journal appears in an international database and is in English. If official approval from the Departmental Committee for Master's Studies is obtained, the article-based thesis will be recognized as an alternative to the standard monograph format of the University of Haifa (as detailed on the Graduate Studies Authority website).

If the thesis is written as a standard monograph, the following apply: the thesis should be written in accordance with the guidelines of the Graduate Studies Authority. The thesis should be written in English and a summary in Hebrew should be attached to the work. In most cases, the body of the thesis should be organized in the following order: scientific background, objectives of the work, methods, results, discussion, and conclusions. If a student has published an article or prepared an article for publication, the student can append the article as a chapter in the thesis.

If the thesis is written as an article-based thesis, the following apply:

Language of article-based theses: An article-based thesis should be written in English, given our recognition that English is the main international language for scientific reporting.

The structure of the thesis: The core of the submitted thesis should comprise a draft of the article (submitted with authorized approval). In addition to this core element, the following sections should be attached, in the order given below:

1. **Cover page and title in English**, in accordance with the guidelines for writing an article-based thesis.
2. **Contents page in English.**
3. **Abstract in English**, laid out in the standard format of the scientific journal that was used as a basis for the article-based thesis.
4. **Introduction.** A literature review of previous works on the research topic. The working hypothesis and research questions should be set out at the end of the introduction chapter. If the introduction to the draft article includes a comprehensive review of previous literature on the scale of a scientific research article, this chapter may contain only the working hypothesis and the research questions.
5. **Research methods.** A detailed explanation of all research methods, that allows examination and criticism of the results obtained. The explanation will include, according to the working methods, a theoretical explanation of the methods, explanations of working procedures, calibration tests, descriptions of standards, errors, and results frequencies, and so on. If the draft article includes a detailed description of the research methods in such a way that permits a full reconstruction of the research by other researchers (in the text or in supplementary information), this chapter is not required.
6. **Results.** The results will be presented in a detailed and structured way, incorporating graphs and charts at a level of detail that will permit the research to be reproduced by other researchers. If the required level of details is included in the draft article, this chapter is not necessary.
7. **Discussion** (in a separate chapter or combined with the results). This will detail the significance and conclusions of the research in the context of the rationale behind the study. The significance of the research findings should be discussed in the context of the main studies in the field published in the scientific literature, emphasizing the importance of the research and its contribution to the field. If possible, future plans for research will be presented.

8. **The draft of the article** as has been submitted or will be submitted to the professional journal for which approval was received. It is important to emphasize that the article should contain new information collected by the student, and make a significant contribution to science. The discussion should detail the implications and conclusions of the research. The significance of the research findings should be discussed in the context of the main studies in the field, as published in the scientific literature.
9. **Additional chapters describing the student's research results**, if any exist that are not included in the article.
10. **List of sources.** This list should include all sources cited in the thesis, both from Section 6 and the rest of the thesis. Citations in the body of the thesis and in the list of sources should be styled according to the instructions of the agreed-upon journal. The list of sources may also be listed separately for each chapter (introduction, methods, and other chapters) according to the discretion of the student and the supervisor. This source chapter is not required if the draft article contains a list of all the sources cited in the thesis (minimum 30 references).
11. **Appendices.** Raw data, items used in experiments and tests during the research, results of statistical processing, test runs, and other data not reported in the body of the work should be included as an appendix if they do not appear in the appendices of the article (supplementary material).
12. **An extended abstract in Hebrew**, which includes background, hypotheses, research questions, the main points of the research method, the main results, and the main significance of the research results and their conclusions.
13. **Cover and title page in Hebrew**, according to the guidelines for writing an article-based thesis. In view of the accepted length of articles in the relevant scientific literature, the thesis should be 25–50 pages in double-spaced English (at least 7,500 words), taking into account the difference in length between the Hebrew and English texts. As noted, theses in article format should be submitted exclusively in English.

The scope of the article-based thesis should not exceed the scope of a monograph thesis.

Evaluation and approval process

The approval of the supervisor(s) that the final written thesis is suitable for submission is a condition for commencing preparations for the final oral examination. After approval is granted, the student must contact the Graduate Studies Authority to have the thesis formally

and technically inspected before submitting it for evaluation to the department administrative office. The student must also contact the school administrative office to obtain written confirmation of completion of all his or her academic and administrative duties. Upon receipt of the required approvals, the supervisor should contact the department administrative office with a request to appoint a thesis examination committee and to set a date for the final lecture (if it has not taken place) and the examination. The thesis examination committee should include the supervisor(s) and two additional examiners, who will receive a copy of the written work.

Article-based theses as detailed above will be evaluated in the same way as theses in the standard monograph format. Evaluation will include a round of comments by a committee with at least three examiners (two examiners, at least one of whom is from the University of Haifa, and the student's supervisors) and will include an overall evaluation of the research and a detailed reference to items that require a written correction. In the case of an article-based thesis, the student's supervisors will be required to state their opinions regarding the student's contribution in collecting the data and writing the article. The examiners will be provided with the journal's editorial guidelines for authors. The thesis examiners will consider all parts of the article impartially, and will try to guide the author in correcting the thesis (if necessary) according to their comments.

The student will also present his or her research in an oral examination, in which the supervisor and two examiners will attend as evaluators. The grade will be determined within the department's currently accepted procedure for awarding thesis grades.

Master's Seminar lecture and oral examination

Each student is required to give a seminar (final Master's seminar) as part of their studies. The Master's seminar and oral examination can (but need not) be held consecutively on the same day. The seminar will be open to the public and participation is mandatory for Master's students in the department (Master's seminar). A week before the seminar, the student should send an abstract of the work to department staff and students. The seminar should last for around 45 minutes, and there will be a discussion at the end, during which the student may answer questions from those attending.

The final oral examination will be held before a designated committee. The committee has the power to demand corrections in the written work. After corrections are made, should they be required, the student should submit a report detailing the changes made together with a

letter from his or her supervisor(s) confirming the completion of the thesis, as required in the examination. At that time, the student should submit a bound copy of the thesis as well as a digital copy. The bound copy should be delivered to the university library. The delivery of the copy of the thesis to the department administrative office and the transfer of the Master's thesis submission form to the Graduate Studies Authority shall be considered as the date of completion of the Master's studies.

Teaching committee

The Master's studies teaching committee will meet once a year to discuss the academic status of all students in the department.

PhD program

A program for doctoral studies in the department is currently under the auspices of the overall University Committee for Research Students.