

MASSACHUSETTS INSTITUTE OF TECHNOLOGY
Department of Electrical Engineering and Computer Science
Graduate Office, Room 38-444

THESIS AND THESIS PROPOSAL

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A. Suggestions and Requirements

1. WHEN TO START ON YOUR THESIS

You should start thinking about your thesis research project at the earliest possible date. At the very least, you should be on the alert for interesting problems that may come to your attention through personal contacts or through the technical literature. New graduate students who do not hold research or teaching appointments are required to register for 6.961, *Introduction to Research in Electrical Engineering and Computer Science* in the fall term to help establish contact with faculty members.

2. THESIS TIME ALLOWANCE

Registration for thesis is normally in blocks of 12 units; two such blocks -- a total of 24 units of registration -- are required by the Department for the SM or EE or ECS thesis. Counting each unit as 15 hours, this represents 360 hours of effort. In the doctoral program, the thesis research is the major feature. The caliber and scope of the doctoral thesis are generally such as to require the equivalent of at least one full-time academic year (96 units) of research.

3. CHOICE OF A THESIS TOPIC

Defining an appropriate topic is an important educational part of the thesis experience. It will require effort on your part; do not expect to be handed a topic. You should endeavor to find one that:

- i. is of such direct and intense interest to you that your enthusiasm is not likely to drop with time and adversity. However, you should realize that there is a variety of possible subjects that are eminently suitable. It is a mistake to spend too much time trying to find "the optimum thesis topic";
- ii. gives you a maximum opportunity to learn--not only about the particular subject being investigated, but more importantly, about the proper methods to use in technical investigation;
- iii. is not so remote from your field of special training that acquiring the necessary background will lead to an excessive delay;
- iv. adds, however modestly, to professional knowledge in the field.

As you begin searching for such a thesis subject, use the resources listed on the Department's Research web page at <http://www.eecs.mit.edu/research>. It might be helpful to:

- i. Question your Graduate Counselor about the well-established programs of research, which are being carried forward in the Department. Your counselor can tell you about the broad nature of these programs, and can direct you to the appropriate persons in each project for further information.
- ii. Consult with those members of the faculty and research staff whose interests lie in the field in which you wish to work. This will be most effective after you have developed some definite ideas of what you wish to do. A list of the Departmental faculty and staff and their interests is available in the Graduate Office, on your EECS flash drive, or at <http://www.eecs.mit.edu/people/faculty-advisors>. It can be particularly helpful to talk with other students who are already active in the research group in which you are interested; they are likely to be accessible and informed about the current state of the research. The web sites for individual groups can also be very helpful.

iii. Attend colloquia and seminars held at frequent intervals by the Department, the Labs, and by most of the research areas. The Department's calendar of events, including doctoral thesis presentations is at <http://www.eecs.mit.edu/news-events/calendar>.

iv. Attend the seminars at the beginning of the fall term each year for students in subject 6.961, *Introduction to Research in Electrical Engineering and Computer Science*, see <http://stellar.mit.edu/S/course/6/fa13/6.961>.

v. Review the annual reports issued by the major research laboratories. These usually give detailed descriptions of individual research projects and list the students and staff associated with the projects. For a list of labs see <http://www.eecs.mit.edu/research>.

vi. Review the graduate theses of recent years on file in the library. You will often find definite suggestions made by the writers for continuance of the work.

4. THESIS PROPOSAL

Each student must submit a thesis proposal for approval by the Department Committee on Graduate Students before undertaking the major work of the research. The proposal should be handed in at the EECS Graduate Office. Instructions for properly preparing the thesis proposal are contained in the following pages. If there are any special features about the contemplated problem that raise questions about its suitability, or if unusual difficulties are encountered in carrying out the procedures below, consult the Graduate Office or your Graduate Counselor.

5. THESIS SUPERVISOR

The majority of theses are supervised by EECS faculty members. Faculty in other departments may also supervise theses. A number of research staff members have been given Departmental approval to supervise theses, and are listed in a pamphlet entitled *Research Interests of Faculty and Staff Members Who Supervise Graduate Theses*, which can be found in the Graduate Office and on your EECS flash drive. Pictures and research interests of EECS Faculty members are located on the EECS website here: <http://www.eecs.mit.edu/people/faculty-advisors>. If you wish to undertake thesis research under the supervision of a non-faculty member who is not listed, you must request specific approval from the Committee on Graduate Students. Such a request should be made through your Area Chair. Appropriately qualified non-faculty may serve as doctoral thesis readers without specific approval; however, at least two members of the doctoral thesis committee (supervisor and readers) must be EECS faculty members.

6. CLASSIFIED THESES

Faculty rules require that copies of all graduate theses shall be deposited in the Institute Library where they are available to the public. Consequently, no student is permitted to embark on a thesis that might be subject to restriction for reasons of either proprietary interest or national security.

7. UNCLASSIFIED THESES DONE IN CLASSIFIED LABORATORIES

Theses done in the Draper Laboratory or MIT Lincoln Laboratory (and in classified areas of other laboratories) are subject to review by government authority to confirm that they are unclassified. A statement must be attached to the proposal when it is submitted for approval indicating that in the best judgment of the student and the research supervisor the thesis will be unclassified (see Appendix 2). A release letter is required when the thesis is submitted (see Appendix 3).

8. OFF-CAMPUS THESES

Thesis research is usually carried out in laboratories operated by MIT and located on the campus. However, in some circumstances, off-campus thesis research is permitted. All such theses must have a faculty supervisor (or approved research staff supervisor) as well as a supervisor at the off-campus location.

Explicit approval is not required for students doing thesis research at MIT Lincoln Laboratory (<http://www.ll.mit.edu>), the Charles Stark Draper Laboratory (<http://www.draper.com>), or for students in the Joint Program with the Woods Hole Oceanographic Institution (<http://mit.whoi.edu>) doing research at Woods Hole.

Students who are in residence, i.e., registered as regular graduate students and paying full tuition, may request permission to pursue thesis research at an off-campus location. The request should be addressed to the Department Committee on Graduate Students and must have the approval of the thesis supervisor. Two necessary conditions for approval of such a request are that

- i. the thesis requires facilities that are not available at MIT;
- ii. the supervisor agrees to supervise the research actively.

If the off-campus location is a commercial or industrial location, there may be special problems of patents, copyrights and conflict of interest that must be addressed. As a general rule, the student may not receive compensation from a company for thesis research.

It is possible for some doctoral students to do their thesis research in absentia paying full tuition or to do a portion of their thesis research off-campus as non-resident students at reduced tuition. The conditions and procedures to be followed in such cases are stated in Graduate Policies and Procedures (<http://web.mit.edu/odg/gpp/degrees>).

(Please see p. 7 for additional information about off-campus research.)

9. INVENTION AND COPYRIGHT AGREEMENTS

Students who receive support from sponsored research or MIT-funded projects or who make significant use of MIT-administered funds and facilities are required to sign the MIT Invention and Copyright Agreement. MIT's policy in regard to intellectual property rights (patents, copyrights, etc.) is described in the *Guide to the Ownership, Distribution and Commercial Development of MIT Technology*, which is available from the Technology Licensing Office (<http://web.mit.edu/tlo/www/community/policies.html>). Students holding fellowships (e.g. NSF Fellows) that impose requirements regarding patents and copyrights should consult with the EECS Graduate Officer.

B. Thesis Proposal for SM and EE/ECS Degrees

The Committee on Graduate Students requires that a thesis proposal be submitted for each SM or EE/ECS thesis before the major work on the thesis is undertaken. Proposals should be brief--preferably no more than ten pages--and should focus on the proposed research. Don't be dismayed if the course of the research seems impossible to predict in detail; make the best preliminary estimate you can. A proposal delayed until the work is nearly completed has little value except as the formal fulfillment of a requirement.

1. TITLE PAGE

The proposal must contain a title page, similar to the sample on page 6, consisting of the following items:

- i. The heading should contain "Massachusetts Institute of Technology, Cambridge, Massachusetts, Department of Electrical Engineering and Computer Science".
- ii. The degree(s) for which the thesis research is intended.
- iii. The tentative title of the thesis, limited, if possible, to eight words or less.
- iv. Your name, mailing address, and signature.
- v. The date of submission of the proposal and the expected date of completion of the thesis.
- vi. The laboratory in which the research will be done.
- vii. A brief statement of the problem consisting of at most a few sentences.
- viii. A signed supervision agreement as shown on the attached sample.

If the thesis is done off-campus, the off-campus supervisor should also sign the thesis proposal. If a change in supervisor becomes necessary, notify the Graduate Office.

If a Master's thesis will also be used to satisfy the thesis requirement for the EE/ECS degree, the following sentence should be added to the supervision agreement, "In evaluating the thesis, I will judge whether it is adequate to satisfy the requirements for the EE/ECS degree."

Sample Title Page for SM Thesis Proposal
(a similar title page can be done for the EE, ECE, or PHD thesis proposal)

Massachusetts Institute of Technology
Department of Electrical Engineering and Computer Science

Proposal for Thesis Research in Partial Fulfillment
of the Requirements for the Degree of
Master of Science

Title: A Novel Design of a Delay-Line Pulse Integrator

Submitted by: A. B. Cook
Ashdown House, Room 675
Cambridge, MA 02139

Signature of author: _____

Date of Submission: May 3, 2013

Expected Date of Completion: June 2014

Laboratory where thesis will be done: Research Laboratory for Electronics

Brief Statement of the Problem:

Re-circulating quartz delay lines have frequently been employed for pulse integration in radar systems. A novel modulation and feedback system is proposed which should permit much longer effective integration time to be achieved with the same stability margin as in present designs. A bread-board model will be constructed.

Supervision Agreement:

The program outlined in this proposal is adequate for a Master's thesis. The supplies and facilities required are available, and I am willing to supervise the research and evaluate the thesis report.

D. E. Fox, Assoc. Prof. of Elec. Eng.

G. H. Iverson, Co-Supervisor
(if done off-campus)

2. BODY OF THE PROPOSAL

The body of the proposal must be well organized and phrased in good English, but the specific arrangement and details of coverage can vary depending on the problem, your preferences, and those of your research supervisor. Each proposal, however, should include at least the following topics.

- i. A brief summary of the background of the problem up to the present must be included giving evidence by reference or otherwise that you have become familiar with this background. In discussing the present status of the problem, you should make evident the extent to which the proposed solution is novel and/or an improvement.
- ii. The probable procedure must be outlined -- from start to finish -- showing which steps are doubtful and therefore subject to change. Include a time schedule that either specifies dates by which various parts of the work should be completed or else allocates a certain number of hours to each major part of the thesis task, such as preparation of samples, experimental work and analysis, correlation and interpretation of results, and preparation of the report. (The total number of hours assigned to a Master's or EE/ECS thesis is nominally 360 hours.)
- iii. A list of the principal equipment and facilities needs must be included, together with the places, which will supply these needs. You should have some assurance that what you need will be available at the time desired. For non-experimental theses, the sources of data (if any) must be stated and the availability of the data assured.
- iv. A bibliography must be included.

The staff of the Writing and Communication Center in the Department of Humanities is available to give assistance with thesis proposals. They provide seminars, workshops and individual help with such matters as organization, style and grammar.

3. JOINT PROPOSAL

If a joint proposal is prepared by two or more students, it should show clearly the division of responsibility, and a copy should be submitted for each student's file in the Graduate Office. However, the Committee on Graduate Students recommends every student to prepare their own individual proposal.

4. OFF-CAMPUS THESIS RESEARCH

If off-campus thesis research has been approved by the Department (see p. 3), it is important that both the student and the off-campus laboratory understand the conditions under which work done off-campus can be accepted by the Institute in fulfillment of the thesis requirement. The conditions to be met are:

- i. All phases of the thesis research must be done under the supervision of a faculty member of the Institute or an MIT staff member approved by the Department. The off-campus supervisor will also sign the thesis. The requirement that the work be done under the supervision of a member of the Institute staff means that in order to evaluate the work of the student the Institute supervisor must be made fully cognizant of each part of the work--why it is done, how it is done, and what results are obtained.
- ii. The Institute must have the privilege of putting the actual thesis document in the MIT Library within 30 days of its receipt at MIT. The student, as owner of the copyright, must give MIT the right to reproduce the thesis and distribute copies publicly. The student may also grant permission to the off-campus laboratory to reproduce and distribute copies of

the thesis in whole or in part. The thesis proposal will not be approved by the Department unless it is accompanied by a signed statement from the off-campus laboratory permitting its performance under the above conditions. (See Appendix 1 for sample letter.)

Topics subject to restrictions for reasons of proprietary interest or national security are not acceptable as the basis for a thesis.

C. Thesis Proposal for Doctoral Degrees

It is expected that candidates for the doctoral degrees will exhibit initiative and judgment in the pursuit of a thesis research program to the extent that most of the rules involved will be those of common sense. There are a few requirements, however, which must be met.

1. DOCTORAL THESIS PROPOSAL

The Department strongly recommends that the doctoral thesis proposal to be under consideration as early as the sixth term. An acceptable doctoral thesis proposal is required by the end of the eighth regular term of registration as a regular graduate student (summer session is not a regular term). If not received by that time, the student's case will automatically be considered by the Department Committee on Graduate Students, which will recommend appropriate action. It is Department policy that students who have not submitted a proposal by the beginning of the ninth regular term will be contacted by the EECS Graduate Officer.

2. FORM

It is not required that a doctoral thesis proposal follow any particular style or format, except that:

- i. A title page similar to that shown for Master's degree thesis proposals should be employed, omitting the supervision agreement at the bottom.
- ii. The title page should be followed by the research supervisor and reader agreements.
- iii. An estimated time schedule with specific dates by which various parts of the work are expected to be completed.

3. SUPERVISOR AND READER AGREEMENTS

The thesis supervisor must be a faculty member of the Institute or an MIT staff member approved by the Department (p. 3). It is customary to discuss the thesis proposal in detail with the supervisor before the final draft is submitted. At least two additional faculty or staff members shall be selected as readers. They will cooperate with the supervisor in evaluating and guiding all phases of the doctoral research program. The supervisor and readers form the student's Doctoral Thesis Committee, which supervises the student's doctoral program and administers the thesis examination when the thesis is substantially complete. At least two members of this committee must be EECS Department faculty members.

The original document of the thesis proposal is submitted to the Graduate Office, and must be accompanied by the signed agreements of the supervisor and readers. These forms may be secured in the Graduate Office, or on your EECS flash drive. If a change of supervisor or reader becomes necessary, a new signed form should be submitted.

D. Final Preparation of Thesis

1. PREPARATION OF THESIS DOCUMENT

"Specifications for Thesis Preparation" prepared by the Director of Libraries is available from the Graduate Office, or at <http://libraries.mit.edu/archives/thesis-specs/> and should be consulted before final preparation is begun.

2. ABSTRACT OF THESIS REQUIRED

After a thesis has been completed, its further value is largely dependent on the extent to which it is read and found useful by others. It is important to supply a well-written abstract, which outlines the scope and achievements of the thesis so that prospective readers can determine whether or not they should read any further. An additional advantage is gained because the abstract will in many cases enable the library staff to catalogue the work more fully and more accurately. Accordingly, the Committee on Graduate Programs requires that each thesis contain an abstract--preferably one typewritten page (single-spaced), but in no case more than two such pages--in which is given a description of the problem and of the procedure used in the investigation, together with a brief statement of the results found or of the conclusions reached. Other material may be included in the summary if you find it pertinent. Your objective is to inform another engineer or scientist, who is not necessarily a specialist in your field, what you worked on, how you did it, and what one may expect to learn about the problem by reading further.

3. NUMBER OF THESIS COPIES REQUIRED

The Department of Electrical Engineering and Computer Science requires that two original copies of each Master's, Electrical Engineer's/Engineer in Computer Science, or Doctor's thesis be handed to the Department Graduate Office. Many of the laboratories in which the thesis research is done also require a copy for their libraries, and in most cases the supervisor wants a copy.

4. COPYRIGHT OF THESIS

The thesis should carry a statement of copyright ownership on the title page. Ownership of the copyright shall reside with the student except when the thesis research is performed in whole or in part, with wages, salary, stipend or grant support, from funds administered by the Institute or if the thesis research is performed in whole or in part utilizing equipment or facilities provided by the Institute under conditions that impose copyright restrictions, in which case the Institute will retain ownership of all copyrights. If you have been a Research Assistant during your thesis research, the Institute will own the copyright. In most other cases the student retains ownership. If a student assigns ownership of the copyright, the student's name should appear on the title page as copyright owner. A notice of the transfer of ownership may be included on a following page. If you have any question as to copyright ownership, consult the Institute's Technology Licensing Office, but please keep the Graduate Office informed. Note that a copyright refers to the document and not to the ideas contained therein.

When copyright ownership rests with the student, the author must, as a condition of a degree award, grant permission to the Institute to reproduce and distribute publicly copies of the thesis. A statement to this effect must appear on the title page.

When copyright resides with the Institute, any further publication, in whole or in part, shall be made only by authorization of the Institute's Technology Licensing Office. This authorization may be requested by letter or by using a form available in the Graduate Office.

5. PUBLICATION OF THESIS

Publication of part, or all, of the thesis in professional journals is encouraged. When copyright resides with the Institute, permission to publish must be obtained as described in the preceding section. If copyright belongs to the student, publication should be discussed with the thesis supervisor.

The publication of the thesis, or any portion thereof, should include the following acknowledgement:

This paper is based on a thesis submitted in partial fulfillment of the requirements for the degree of <degree name> in the Department of Electrical Engineering and Computer Science at the Massachusetts Institute of Technology in <month, year>.

If the work was supported by a project, fellowship, grant, etc., acknowledgement of the sponsorship should be included.

6. JOINT THESES

The Department may approve joint research for the SM degree. However, since the preparation of the final document is an important part of the educational value of the thesis research, each student must submit a distinct document. Where possible, the individual contributions of each student should be identified. The thesis supervisor will provide guidance concerning the material that can be common to the two theses.

Appendix 1

OFF-CAMPUS PROPOSAL AGREEMENT LETTER (See Appendix 2 if thesis is subject to classification review.)

Department of Electrical Engineering and Computer Science
Room 38-444
Massachusetts Institute of Technology
Cambridge, MA 02139

Attention: Professor L. A. Kolodziejski

Subject: Master's Thesis of (name of student)

The attached proposal (title and date) describes a research study that (name of student) intends to carry out as an MIT student using, at least in part, the facilities of (name of off-campus laboratory). (Name of student) further intends to prepare a thesis based on this research study to be submitted to MIT as one of the requirements for the Master of Science degree. We understand that, if such a report is to be acceptable to MIT, faculty regulations establish the following requirements.

- i. The research study must also be supervised by a member of the MIT staff who can have full access (during the course of study and in confidence) to the pertinent background, methods of investigation and results.
- ii. Research studies and thesis topics involving subject matter (including data, results, or methods) subject to restriction for reasons of either proprietary interest or national security are unacceptable as the basis for a thesis.
- iii. The actual thesis document becomes the permanent property of MIT, and will be placed in the MIT Library within one month of the date of submission.
- iv. In order for the thesis to be accepted, it must be initially copyrighted in the name of the student who must give MIT the right to reproduce the thesis and to distribute copies publicly. (Name of laboratory) agrees that MIT will be given the nonexclusive right to reproduce, publish and publicly distribute the thesis, even if the student has assigned the copyright to (name of laboratory).

It is our belief that the proposed research can be carried out and an acceptable thesis prepared under these conditions.

We also understand that except as noted above, and provided that (name of student) is not associated with any government or other sponsored project at MIT in the field of the research study and does not make significant use of MIT funds or facilities, all rights in the results of the research including any inventions or software developed by (name of student) in the course of this research study and thesis preparation, belong either to (name of student) or (name of laboratory) as his/her assignee.

Authorized Official
of Laboratory

Off-campus Supervisor
of Student

Student

Appendix 2

OFF-CAMPUS PROPOSAL AGREEMENT LETTER (For theses being done at the Charles Stark Draper Laboratory or other theses subject to classification review)]

Department of Electrical Engineering and Computer Science
Room 38-444
Massachusetts Institute of Technology
Cambridge, MA 02139

Attention: Professor L. A. Kolodziejski

Subject: Master's Thesis of (name of student)

The attached proposal (title and date) describes a research study that (name of student) intends to carry out as an MIT student using, at least in part, the facilities of (name of off-campus laboratory). (Name of student) further intends to prepare a thesis based on this research study that will be submitted to MIT in partial fulfillment of the requirements for the Master of Science degree. We understand that if such a thesis is to be acceptable to MIT, faculty regulations establish the following requirements.

- i. The research study must also be supervised by a member of the MIT staff who can have full access (during the course of study and in confidence) to the pertinent background, methods of investigation and results.
- ii. Research studies and thesis topics involving subject matter (including data, results, or methods) subject to restriction for reasons of either proprietary interest or national security are unacceptable as the basis for a thesis.
- iii. The actual thesis document becomes the permanent property of MIT, and will be placed in the MIT Library within one month of the date of submission.
- iv. In order for the thesis to be accepted, it must be initially copyrighted in the name of the student who must give MIT the right to reproduce the thesis and to distribute copies publicly. (Name of laboratory) agrees that MIT will be given the nonexclusive right to reproduce, publish and publicly distribute the thesis, even if the student has assigned the copyright to (name of laboratory). The thesis will not be given general circulation until a review by the Office of the Secretary of Defense has been completed and the thesis declared unclassified.

It is our belief that the proposed research can be carried out and an acceptable thesis prepared under these conditions.

We also understand that except as noted above, and provided that (name of student) is not associated with any government or other sponsored project at MIT in the field of the research study and does not make significant use of MIT funds or facilities, all rights in the results of the research including any inventions or software developed by (name of student) in the course of this research study and thesis preparation, belong either to (name of student) or (name of laboratory) as his/her assignee.

Authorized Official
of Laboratory

Off-campus Supervisor
of Student

Student

Appendix 3

THESIS RELEASE LETTER

(For theses being done at the Charles Stark Draper Laboratory
or for other theses subject to classification review)

Department of Electrical Engineering and Computer Science
Room 38-444
Massachusetts Institute of Technology
Cambridge, MA 02139

Attention: Professor L. A. Kolodziejcki

Subject: Master's Thesis of (name of student)

I have reviewed the attached thesis of (name of student) on behalf of (name of laboratory). The thesis is within the scope of the thesis proposal as previously approved and does not contain any material that is objectionable to (name of laboratory). It is also approved for its technical content.

It is understood that the actual thesis document will be the permanent property of MIT and will be placed in the MIT Library within one month after the date of submission. However, the thesis will not be given general circulation until a review by the Office of the Secretary of Defense has been completed and the thesis released by the sponsor for general use. I will inform the Department of the results of such review as soon as possible. (Name of laboratory) agrees that MIT shall have the nonexclusive right to reproduce, publish, and distribute the thesis.

Authorized Official of Laboratory

(Name and Title)