

Graduate Student Handbook
for the
Materials Science Program
at the
University of New Hampshire

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Materials Science Program

Table of Contents

1	Welcome by the Program Director	3
2	Coursework Information	3
2.1	Introduction	3
2.2	General Course Information	4
2.3	Maintaining Student Status	5
2.4	Time Limits for Coursework and Research	5
2.5	Grade Requirements	5
2.6	Transfer of Courses or Credits	5
2.7	Degree Requirements in Materials Science	6
2.7.1	Master's in Materials Science – Master's Thesis Option	6
2.7.2	Master's in Materials Science - Master's Project Option	8
2.7.3	Ph.D. in Engineering with Materials Science Option	8
2.8	Change in Degree Objective	9
2.8.1	Changing From the Master's to the Ph.D. Degree Objective	9
2.8.2	Changing from the Ph.D. to the Master's Degree Objective	10
3	Research	10
3.1	Thesis Work	11
3.1.1	Thesis Committee	11
3.1.2	Completion of a Thesis	12
3.1.3	Intent to Graduate	13
3.2	Requirements to advance to candidacy (Ph.D. level)	13
3.2.1	Review Paper	13
3.2.2	Research Proposal	14
3.3	Progress Towards Degree	15
4	Appendices	17
4.1	Appendix 1 - Checklist for M.S. degree	17
4.2	Appendix 2 - Checklist for Ph.D. degree	19

1 Welcome by the Program Director

Welcome to the Materials Science Program at the University of New Hampshire. Our Program offers research opportunities in areas of science and engineering that cross traditional departmental boundaries. We offer M.S. and Ph.D. degrees that provide our students with expertise in specific fields of materials science and also expose them to a broad range of research topics. Students learn about the interplay of structure, processing, characterization, and properties of materials with useful applications. Our faculty members are active collaborators with research and development groups both locally and internationally, and are experienced in managing research projects with practical results. Graduates of the Materials Science Program are working in research, engineering and process development positions in a variety of fields. This Graduate Student Handbook is a guide to the process of obtaining an M.S. or Ph.D. degree in the Materials Science Program. The Handbook provides information on degree requirements, courses and research, and checklists to monitor progress towards completion. Please review the information available from the UNH Graduate School (<http://www.gradschool.unh.edu/>) and be sure to read and understand the Guide to Student Rights, Rules and Responsibilities (<http://www.unh.edu/student/rights/>). This document describes important university policies regarding your role as a member of the University community, including ethical conduct in academics and research. We look forward to working with you, and we welcome any questions about the Program from students and potential collaborators interested in the materials science resources at UNH.

Olof E. Echt, Director, UNH Materials Science Program

2 Coursework Information

2.1 Introduction

The field of Materials Science has been viewed as the inter-relationship among three areas: (1) characterization, (2) synthesis and processing, and (3) structure/property relationships. The required courses in the Materials Science Program at the University of New Hampshire have been designed to reflect the importance of each of these three areas within the field. Beyond two fundamental courses in Thermodynamics and Kinetics of Materials, students will choose electives within these three areas of the field. In addition to courses, it is expected that all

graduate students regularly attend the Materials Science Seminars (MS 900) that are usually held weekly.

2.2 General Course Information

Graduate-level courses are numbered in the 800's and 900's; most of a graduate student's courses will be chosen from these two numbered groupings. Master's Degree students are required to take a minimum of 6 credits at the 900-level. Ph.D. students are required to take a minimum of 12 credits at the 900-level.

Students who feel unprepared for any of the basic courses (refer to Section 2.7.1) should consider taking an appropriate upper level undergraduate course (s) before proceeding to graduate work. Students should consult the professor for the course or the graduate advisor if they have questions about prerequisites for the selected course (s). Students may also take relevant graduate level courses in other departments (e.g. Math, Chemistry, Physics, or the various engineering disciplines). The graduate advisor must decide if a course in another department is acceptable for graduate credit in the Materials Science Program. Students who are completing a Master's Thesis should register for MS 899 – Master's Thesis for a maximum of six credits, and those students who are completing a Master's Project should register for MS 898 – Master's Project for a maximum of three credits. Once students have completed all course requirements and registered for the maximum number of thesis or project credits, and are **in residence** completing their master's program, they must register for GRAD 900 – Master's Continuing Research. Students registered for GRAD 900 are considered full-time. All continuing graduate students who are not enrolled in course credits, thesis or project credits and are **not in residence**, are required to register for GRAD 800 – Continuing Enrollment, each semester of the academic year. Students registered for Grad 800 are considered part-time. Doctoral students must register for MS 999 - Doctoral Research each semester after advancement to candidacy until their doctoral degree is conferred, even if the minimum of two semesters has been met. Students registered for MS 999 are considered full-time.

2.3 Maintaining Student Status

All teaching and research assistants must take 6 credits per semester to be considered full time students; all other graduate students must take 9 credits per semester to have full-time status.

2.4 Time Limits for Coursework and Research

Ph.D. students are normally expected to finish their coursework by the middle of their third year so that they are prepared to complete the Research Proposal (see Section 3.2.2) by the end of their third year.

Full time Master's students are normally expected to complete their thesis within two years from the beginning of their program. Full time Ph.D. students will take various times to complete their degree requirements and thesis depending on a number of circumstances. Normally they are expected to graduate within 4 to 6 years from the beginning of their program.

2.5 Grade Requirements

A grade of B- or better is required for all courses taken at the graduate level. If a student receives a lower grade in a course, he/she must retake the course in order for it to count toward his/her degree. Students who receive three grades of C⁺ or lower are no longer eligible to continue in the graduate program.

2.6 Transfer of Courses or Credits

The Graduate School does not allow transfer of credits for courses that have been taken for an already-conferred degree, i.e. (the same course cannot count for more than one degree). Students who have done graduate work at other schools (i.e., students who enter the Ph.D. program with an existing Master's degree) *and* who have already taken courses similar to those in the Materials Science Program, should see their advisor as soon as possible about planning an appropriate "program of study" that meets the UNH degree requirements. The director of the Materials Science Program must then approve this program of study. Under certain circumstances, undergraduate courses may be used to substitute for a required graduate course. However, the credit hours are usually not transferable (since one course cannot count for two degrees) so another graduate course must be added in place of the required course. In the special

case of students who have applied for “early admission” to the Materials Science Program, they may be able to receive credit for up to two appropriate courses taken at the undergraduate level.

2.7 Degree Requirements in Materials Science

There are three degree programs offered in Materials Science at the University of New Hampshire. They include two Master’s Degrees: (1) a Master’s in Materials Science Thesis Option, (2) a Master’s in Materials Science Project Option, and finally, a Ph.D. in Engineering with a Materials Science Option. The course requirements for each of these are described in the sections that follow below.

2.7.1 Master’s in Materials Science – Master’s Thesis Option

Required Courses

The Master’s Thesis Option requires a total of 30 credits, which include 24 course credits and 6 thesis credits (MS 899). At least 6 credits must be at the 900 level. The following courses are required by all students:

MS 860	Thermodynamics and Kinetics of Materials I	3 credits
MS 961	Thermodynamics and Kinetics of Materials II	3 credits
MS 900	Materials Science Seminar	2 credits
	(Two semesters of MS 900 are required)	
MS 899	Master’s Thesis	6 credits
	(6 credits of MS 899 are required)	

Elective Courses

Additionally, each student will choose one elective from each of these areas within Materials Science: characterization, synthesis and processing, and structure/property relationships. The following is a list of courses within these areas:

Characterization Courses

MS 861	Diffraction and Imaging Methods in Materials Science	4 credits
MS 910	Macromolecular Characterization	3 credits
MS 965	Advanced Surface and Thin Film Characterization	4 credits
CHEM 808	Spectroscopic Investigation of Organic Molecules	3 or 4 cr.
CHEM 908	Applied Multi-Nuclear Magnetic Resonance Spectroscopy	3 credits
CHEM 917/8	Advanced NMR Spectroscopy	3 credits

Synthesis and Processing Courses

MS 863	Thin Film Science and Technology	4 credits
MS 905	Macromolecular Synthesis	3 credits
CHE 801	Introduction to Polymer Engineering	4 credits
CHEM 855	Advanced Organic Chemistry	3 credits
CHEM 903	Advanced Inorganic Chemistry	3 credits
CHEM 911	Synthetic Organic Chemistry I	3 credits

Structure/Property Relationships Courses

MS 830	Mechanical Behavior of Materials	4 credits
MS 831	Fracture and Fatigue of Engineering Materials	4 credits
MS 844	Corrosion	4 credits
MS 862	Electronic Materials Science	4 credits
MS 915	Properties and Processing of Polymer Fluids and Solids	3 credits
BCHM 850	Physical Biochemistry	3 credits
BCHM 851	Principles of Biochemistry I	4 credits
CHEM 901	Theoretical Organic Chemistry I	3 credits
CHEM 902	Theoretical Organic Chemistry II	3 credits
CHEM 905	Advanced Physical Chemistry	3 credits
CHEM 995	Nano-Manufacturing I ^{*)}	1 credit
CHEM 995	Nano-Manufacturing Seminar ^{*)}	1 credit
ME 835	Mechanics of Composite Materials	4 credits
ME 935	Micromechanics of Composite and Porous Materials	4 credits
PHYS 818	Introduction to Solid State Physics	4 credits
PHYS 965	Advanced Solid State Physics	3 credits

^{*)} These courses do not count towards the requirement to take at least one course from each of the three areas.

After satisfying the requirement of one course in each of these areas, students may elect other courses in Materials Science, Math, Chemistry, Physics, Biochemistry, and the various engineering disciplines with permission.

These course requirements are outlined in the Master's in Materials Science Student Requirement Checklist as shown in Appendix 1. This checklist serves as a guideline for student progress during their stay in the Materials Science Program.

2.7.2 Master's in Materials Science - Master's Project Option

The Master's Project Option also requires a total of 30 credits, which includes 27 course credits and 3 project credits (MS 898). The project may be theoretically or experimentally based but will be significantly less intensive than a thesis. The project will be defined and evaluated by the student's advisor. At least 6 credits of coursework must be at the 900 level. The remaining course requirements are the same as that of the Master's Thesis Option.

2.7.3 Ph.D. in Engineering with Materials Science Option

The Ph.D. in Engineering with a Materials Science Option requires 39 course credits beyond a baccalaureate degree, as well as a significant amount of research. All students (including those with an existing Master's Degree) must complete the following:

- a. The course requirements listed under the Master's in Materials Science Thesis Option (24 course credits, including MS 860, MS 900, MS 961, plus 15 credits of elective courses with at least one course in each of the three areas of characterization, synthesis and processing, and structure/property relationships)
- b. Five *additional* elective courses, and
- c. A minimum of two semesters of MS 999 (thesis research)

A total of 12 credits of coursework must be at the 900-level (including those courses taken at the Master's level). After advancing to candidacy, the student must enroll in MS 999 (thesis research) every semester until graduation.

These course requirements are outlined in the Ph.D. in Appendix 2. This checklist serves as a guideline for student progress during their stay in the Materials Science Program.

If a student enrolls in the Ph.D. program when having already earned a Master's degree that contained courses similar to those in the Materials Science Program at the University of New Hampshire, then an alternate "plan of study" will be proposed for the student upon acceptance into the Materials Science Program at the University of New Hampshire. This proposed plan of study will be approved by the faculty of the Materials Science Program and then submitted to the Dean of the Graduate School for approval.

2.8 Change in Degree Objective

Some students may desire to change their degree objective while in the program, either from the Master's to the Ph.D. degree or from the Ph.D. to the Master's degree.

2.8.1 Changing from the Master's to the Ph.D. Degree Objective

During the course of the first two years in the program a student enrolled with a Master's degree objective may desire to continue on for a Ph.D. degree. The feasibility of this option will strongly depend upon the student's performance in the program up until that time and especially upon the demonstrated ability of the student to pursue independent research. The procedure that must be followed is:

- a. The student must contact her/his advisor (or the program director if an advisor has not yet been assigned) to indicate the desire to change degree objective.
- b. The advisor will discuss this option with the student's thesis committee and gain their perspective on the matter after a thorough review of the student's performance and promise in research. If there is no advisor at this point in time, the program director will review the student's performance and promise in research, and then discuss this option with several other Materials Science Program faculty members. In either case the student will be informed of the faculty opinion in a timely manner. Once the advisor's and/or Program Director's consent is granted, the student may petition the graduate school to make the change. To do this, the student should obtain and complete an official *Graduate Student Application For Change In Degree Program* (see <http://www.gradschool.unh.edu/pdf/cod.pdf>). The completed form should be taken to the Graduate School, along with two letters of recommendation from MSP faculty, one of which should be from the student's advisor or, in the event that an advisor has yet to be chosen, the MSP director. GRE scores may also be required if they are not already on file at the Graduate School.
- c. If the decision to make the change is positive, the student should work with the advisor (or the program director if there is no advisor at that moment) to determine whether or not the student needs to complete a Master's Thesis before continuing on towards the Ph.D. degree. In some cases it will be possible to move directly to the Ph.D. program and

complete only the Ph.D. thesis. This may depend more upon the topic and scope of the Master's Thesis research than anything else.

2.8.2 Changing from the Ph.D. to the Master's Degree Objective

There may be instances in which the student wishes to change from the Ph.D. to the Master's degree objective and the reasons may be quite varied. If this change is requested by the student while in good standing within the program, the student should talk with his/her advisor and the program director to inform them of the reasons for the change and to make sure that she/he understands what work, if any, needs to be completed before the Master's degree can be awarded (if such an award has not already been made). With that clarification, the student should obtain and complete an official *Graduate Student Application For Change In Degree Program* (see <http://www.gradschool.unh.edu/pdf/cod.pdf>). The completed form should be taken to the Graduate School.

Should the student fail to pass both the review paper (see Section 3.2.1) and the research proposal (see Section 3.2.2), the program faculty will prepare a set of expectations that the student should fulfill in order to remain in the program. If the student fails to fulfill those expectations, the program faculty may require the student to change degree objectives and complete any remaining work (if any) necessary for the Master's degree (if not yet awarded). In this case the program director will work with the Dean of the Graduate School to make the appropriate change.

3 Research

The pursuit of research is one of the major goals of Materials Science graduate education. Therefore, the graduate students will seek the advice of faculty involved in the research areas of interest to the student. A detailed description of these research fields may be found in the Materials Science Web Site. During their first year at UNH, graduate students should choose their research advisor. Generally speaking, graduate students are strongly encouraged to meet with all possible faculty members before selecting a graduate advisor.

3.1 Thesis Work

Thesis work officially begins as soon as the thesis advisor is selected. While research work is being completed, students register for MS 999 (Ph.D. thesis work) or MS 899 (Master's thesis work). The thesis advisor provides the student with an outline of the expected thesis project. Because a thesis will be original research, changes of the scope may occur during the work on the project. However, the scope of the study should only be extended by agreement with the student and the Thesis Committee. The student should feel free to suggest shifts of the scope, which are in his/her own interest. Those supported by external grants and contracts will have to do this in the context of the objectives of such grants and contracts.

The expected duration of a thesis may vary from topic to topic and may depend on accessibility of major experimental hardware during the project and available resources. If unduly long delays are expected from problems with the availability of resources, the thesis advisor shall explore alternate scopes of the thesis with the student to allow the finishing of the thesis within a reasonable time period. All full time Master's students are normally expected to complete their degree within a 2 year period. Full time Ph.D. students will take various times to finish their degrees but are normally expected to finish their degrees within 4 to 6 years from the baccalaureate degree.

3.1.1 Thesis Committee

The purpose of the Thesis Committee is to oversee the progress of the thesis work and propose changes to the scope of the work, if appropriate. The student may seek advice from any member of the Thesis Committee with regard to his/her thesis and related questions. The Thesis Committee will be involved in the evaluation of the thesis and the defense of the thesis. In the case of the Ph.D. level, the Thesis Committee is also in charge of evaluating the review and proposal papers (See Section 3.2, Requirements to Advance to Candidacy).

The members of the Thesis Committee (minimum of five for a Ph.D. thesis, minimum of three for a Master's thesis) will be selected by the student and the thesis advisor after the thesis topic is selected. If both cannot agree on a suitable thesis committee, the thesis committee will be chosen by the program director. The thesis advisor is always on the committee. At the Ph.D. level, three faculty members should be from within the program and in a research field closely related to the thesis work, while a fourth faculty member (who may be within the program)

should be selected from a field not related to the research. The fifth faculty member must come from outside of the Materials Science Program. If collaboration with an outside research institution is a vital part of the thesis work, an external scientist or engineer may be added to the committee at the request of the student and/or thesis advisor. In such a case, the scientific reputation of the external researcher must be documented by a curriculum vita and approved by the program director.

After agreement on a slate of potential thesis committee members, the student then discusses this with the potential members to determine their willingness to serve on the committee. A brief written outline of the thesis project should be given to the prospective committee member so he/she may make an informed decision regarding whether to serve on the thesis committee or not. In the case of a Master's degree candidate, the thesis committee should be determined no later than three months before the defense. The three members may all be faculty within the program. An acceptable alternative is having one member who is non-program faculty.

In the case of a Ph.D. thesis, the thesis committee should be determined as soon as the student is ready to go through candidacy requirements. Usually, the thesis committee is expected to be selected by the spring term of a second year for a student who has started in fall. The thesis committee must then be approved by the full faculty of the program, at the occasion of a faculty meeting, and finally by the Dean of the Graduate School, who officially appoints it.

3.1.2 Completion of a Thesis

When the research objectives are completed, the candidate will write a thesis and submit a draft to the Thesis Committee. It is normally expected that the candidate will be in frequent contact with the thesis advisor during the writing of this thesis. Before submission of the final thesis, the candidate will defend his/her thesis to the Thesis Committee. The defense consists of two parts and takes a total of about 2 hours. The first part is a seminar open to the public. In general, the candidate will present an oral overview of the thesis for about 45 minutes, which will be followed by questions from the members of the audience. At the end of that period the audience will be asked to leave and the Thesis Committee will continue to discuss the details of the work with the thesis candidate for about an hour. They will then ask the candidate to leave in order to discuss the merits of the thesis and the defense and will then advise the candidate of the result.

A final copy of the approved thesis is to be submitted to the Graduate School. Before the student begins writing the thesis, it is recommended that he/she get current information from the Graduate School on the format of the thesis and number of copies required. As of this writing, a minimum of three copies is required for a Ph.D. thesis (one for the grad school microfiche, a bound copy for the physics, chemistry or engineering library, and a bound copy for the main library). Only the two bound copies for the libraries are required for a Master's thesis.

The last date a thesis defense may be scheduled is typically two weeks before graduation, but may vary from semester to semester. It is announced every year in the academic calendar of the university. To allow adequate time for reading the thesis by the committee members and the necessary preparation of the defense, the candidate should plan for completion of the thesis about one month before the planned date of the defense.

3.1.3 Intent to Graduate

Students must file an Intent to Graduate Form at the Registrar's Office during the semester in which they expect to graduate. This form must be filed early in the semester in order to avoid a late fee. Students rarely know with certainty whether they will graduate in a given semester, however they are allowed to file the form and not graduate, while it is impossible to graduate if the form has not been filed.

3.2 Requirements to advance to candidacy (Ph.D. level)

To advance to candidacy, the student must complete:

- An M.S. degree or 24 credits of graduate courses with at least six credits at the 900 level, and,
- The two qualifying examinations described below (review paper and research proposal).

3.2.1 Review Paper

The student must submit a substantive review paper and deliver an oral presentation on that paper. The review paper is expected to be presented before the end of the second year of full time work. The review paper can be in the same field as the candidate's research, but cannot be closely related to the thesis topic. It is strongly recommended that the candidate work with the

thesis advisor to determine if the choice of topic and breadth of coverage are suitable for a review paper. The candidate must submit the final version of the review paper to all the members of the Thesis Committee no later than two weeks prior the date of the oral examination. The time and location for the defense should be announced to all members of the Materials Science Program by way of email. The oral examination comprises a 30-minute seminar followed by questions from the audience. At the end of this period the audience will be asked to leave and the Thesis Committee will continue to discuss the review paper with the student.

At the end of the question sessions, the Thesis Committee will decide whether:

- a. the student passes and should proceed to the research proposal exam within the following year, or
- b. the student should revise and resubmit the review paper to the committee within three months and schedule a second oral defense.

After resubmission of the paper, and eventually after the second defense, the committee should decide whether the candidate passes (see a.) or fails. In the latter case, the entire program faculty will be briefed by the members of the Thesis Committee and will recommend whether or not the student should continue in the program. If it is decided that the student is allowed to continue, the program faculty will prepare a set of expectations that the student should fulfill in order to remain in the program.

A substantive record of publication in conjunction with an oral presentation at a conference may substitute for the review paper. The program faculty members of the Thesis Committee will decide whether the previous publication record is substantive and make a recommendation to the entire program faculty who should approve the substitution.

3.2.2 Research Proposal

The student must present a written research proposal adhering to NSF or NIH guidelines, followed by an oral defense of that proposal. This exam should be taken before the end of year three of full time work. The research proposal can be in the same field as the candidate's research, and may be related to the thesis topic, if desired. The candidate must work with the thesis advisor to determine whether the choice of topic and breadth of coverage are suitable for a research proposal. The candidate must submit the final version of the research proposal to all the

members of the Thesis Committee no later than two weeks prior the date of the oral examination. The oral examination comprises a 30-minute seminar followed by questions from the audience. This part of the oral defense is open to the public, and time and location for the defense should be announced to all members of the Materials Science Program by way of email. At the end of this first question period the audience will be asked to leave and the Thesis Committee will continue to examine the student.

At the end of the question sessions, the Thesis Committee will decide whether:

- a. the student passes and is able to advance to candidacy, assuming that all other criteria are fulfilled, or
- b. the student should revise and resubmit the research proposal to the committee within three months and schedule another oral defense.

After resubmission of the proposal, and eventually after the second defense, the committee will decide whether the candidate passes (see a.) or fails. In the latter case, the entire program faculty will be briefed by the members of the Thesis Committee and will recommend whether or not the student should continue in the program. If it is decided that the student is allowed to continue, the program faculty will prepare a set of expectations that the student should fulfill in order to remain in the program.

3.3 Progress Toward Degree

The performance of each student will be reviewed annually by a group of Materials Science Program faculty (which may be the Thesis Committee, but not necessarily), and recommendations will be made to the student concerning the subsequent program. This review will occur at the end of the summer or at the beginning of the fall semester for all M.S. students, and for Ph.D. students who have not advanced to candidacy. Course performance, language proficiency, seminar participation, preliminary examination results, and research efforts will be considered during this review. The results of the review will be documented in the progress review form (see Appendix 1 and 2). One copy of this form will be placed in the student's personal file at the Program Office, and another copy will be given to the student. After this review, students will be informed whether continuing in the program is advisable, and will be

apprised of any weaknesses. If there appears to be a definite indication that only attainment of an M.S. is probable, the student shall be so informed.

Ph.D. students who have advanced to candidacy should meet yearly with at least three members of the Thesis Committee in order to assess progress toward thesis completion. In this case, the student will contact each thesis committee member and set up a meeting date that is suitable to at least three of the members of the committee. One of these members must be the thesis advisor. After the review, the committee should recommend whether or not the student should expect to graduate within the next year.

4 APPENDICES

4.1 Appendix 1

Master of Science in Materials Science Student Requirements Checklist

Name of Student: _____ Date of Entry: _____

Advisor: _____

Thesis Committee: _____

Thesis Credits: _____

Date of Thesis Defense: _____ Title _____

Course Requirements

Student must present at least 30 credits for completion of MS program with 24 course credits and no fewer than 6 credits in thesis research (#MS 899). The two core courses (MS 860 and MS 961) are required. In addition one course must be taken in each of the following categories: Characterization, Synthesis & Processing, and Structure/Property Relationships.

Seminar: #900 (1cr) Semester taken _____ Title: #1 _____

and #900 (1cr) Semester taken _____ Title: #2 _____

Required core courses (2):

#	Title	Credits	Semester Taken	Grade
MS 860	Thermodynamics & Kinetics of Materials I	3	_____	_____
MS 961	Thermodynamics & Kinetics of Materials II	3	_____	_____

Characterization Courses:

#	Title	Credits	Semester Taken	Grade
MS 861	Diffraction & Imaging Methods in Mat Sci	4	_____	_____
MS 910	Macromolecular Characterization	3	_____	_____
MS 965	Adv. Surface & Thin Film Characterization	4	_____	_____
CHEM 808	Spectroscopic Investigations Org. Molecules	3 or 4	_____	_____
CHEM 908	Applied Multi-Nuclear Magn. Res. Spectr.	3	_____	_____
CHEM917/8	Advanced NMR Spectroscopy	3	_____	_____

Other:

#	Title	Credits	Semester Taken	Grade
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

Synthesis & Processing Courses:

#	Title	Credits	Semester Taken	Grade
MS 863	Thin Film Science & Technology	4	_____	_____
MS 905	Macromolecular Synthesis	3	_____	_____
CHE 801	Introduction to Polymer Engineering	4	_____	_____
CHEM 855	Advanced Organic Chemistry	3	_____	_____
CHEM 903	Advanced Inorganic Chemistry I	3	_____	_____
CHEM 911	Synthetic Organic Chemistry I	3	_____	_____

Other:

#	Title	Credits	Semester Taken	Grade
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

Structure/ Property Relationships Courses:

#	Title	Credits	Semester Taken	Grade
MS 830	Mechanical Behavior of Materials	4	_____	_____
MS 831	Fracture and Fatigue of Engineering Materials	4	_____	_____
MS 844	Corrosion	4	_____	_____
MS 862	Electronic Materials Science	4	_____	_____
MS 915	Prop. & Proc. Polymer Fluids & Solids	3	_____	_____
BCHM 850	Physical Biochemistry	3	_____	_____
BCHM 851	Principles of Biochemistry I	4	_____	_____
CHEM 901	Theoretical Organic Chemistry I,	3	_____	_____
CHEM 902	Theoretical Organic Chem II	3	_____	_____
CHEM 905	Advanced Physical Chemistry	3	_____	_____
CHEM 995	Nano-Manufacturing I	1 ^{a)}	_____	_____
CHEM 996	Nano-Manufacturing Seminar	1 ^{a)}	_____	_____
ME 835	Mechanics of Composite Materials	4	_____	_____
ME 935	Micromech. Composite & Porous Materials	4	_____	_____
PHYS 818	Introduction to Solid State Physics	4	_____	_____
PHYS 965	Advanced Solid State Physics	3	_____	_____

a) These courses do not count toward the requirement to take at least one course from each of the three areas

Other:

#	Title	Credits	Semester Taken	Grade
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

Other courses taken:

#	Title	Credits	Semester Taken	Grade
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

Annual Review Committee

Date	Committee	Comments
Year 1		
Year 2		

4.2 Appendix 2

Ph.D. in Engineering - Materials Science Student Requirements Checklist

Name of Student: _____ Date of Entry: _____

Advisor: _____

Thesis Committee (year 2): _____

Thesis Credits: _____

Date of Thesis Defense: _____ Title _____

Course Requirements

Student must present 39 course credits beyond the baccalaureate degree including MS 860, MS 900, MS 961, plus 15 credits of elective courses with at least one course in each of the following categories: Characterization, Synthesis & Processing, and Structure/Property Relationships, plus *five additional* elective courses, and a minimum of two semesters of MS 999 (thesis research). A total of 12 credits of coursework must be at the 900 level.

Seminar: #900 (1cr) Semester taken _____ Title: #1 _____

and #900 (1cr) Semester taken _____ Title: #2 _____

Required core courses (2):

#	Title	Credits	Semester Taken	Grade
MS 860	Thermodynamics & Kinetics of Materials I	3	_____	_____
MS 961	Thermodynamics & Kinetics of Materials II	3	_____	_____

Characterization Courses:

#	Title	Credits	Semester Taken	Grade
MS 861	Diffraction & Imaging Methods in Mat Sci	4	_____	_____
MS 910	Macromolecular Characterization	3	_____	_____
MS 965	Adv. Surface & Thin Film Characterization	4	_____	_____
CHEM 808	Spectroscopic Investigations Org. Molecules	3 or 4	_____	_____
CHEM 908	Applied Multi-Nuclear Magn. Res. Spectr.	3	_____	_____
CHEM917/8	Advanced NMR Spectroscopy	3	_____	_____

Other:

#	Title	Credits	Semester Taken	Grade
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

Synthesis & Processing Courses:

#	Title	Credits	Semester Taken	Grade
MS 863	Thin Film Science & Technology	4	_____	_____
MS 905	Macromolecular Synthesis	3	_____	_____
CHE 801	Introduction to Polymer Engineering	4	_____	_____
CHEM 855	Advanced Organic Chemistry	3	_____	_____
CHEM 903	Advanced Inorganic Chemistry I	3	_____	_____
CHEM 911	Synthetic Organic Chemistry I	3	_____	_____

Other:

#	Title	Credits	Semester Taken	Grade
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

Structure/ Property Relationships Courses:

#	Title	Credits	Semester Taken	Grade
MS 830	Mechanical Behavior of Materials	4	_____	_____
MS 831	Fracture and Fatigue of Engineering Materials	4	_____	_____
MS 844	Corrosion	4	_____	_____
MS 862	Electronic Materials Science	4	_____	_____
MS 915	Prop. & Proc. Polymer Fluids & Solids	3	_____	_____
BCHM 850	Physical Biochemistry	3	_____	_____
BCHM 851	Principles of Biochemistry I	4	_____	_____
CHEM 901	Theoretical Organic Chemistry I,	3	_____	_____
CHEM 902	Theoretical Organic Chem II	3	_____	_____
CHEM 905	Advanced Physical Chemistry	3	_____	_____
CHEM 995	Nano-Manufacturing I	1 ^{a)}	_____	_____
CHEM 996	Nano-Manufacturing Seminar	1 ^{a)}	_____	_____
ME 835	Mechanics of Composite Materials	4	_____	_____
ME 935	Micromech. Composite & Porous Materials	4	_____	_____
PHYS 818	Introduction to Solid State Physics	4	_____	_____
PHYS 965	Advanced Solid State Physics	3	_____	_____

a) These courses do not count toward the requirement to take at least one course from each of the three areas

Other:

#	Title	Credits	Semester Taken	Grade
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

Other courses taken:

#	Title	Credits	Semester Taken	Grade
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

Review Paper Examination (by end of year 2)

Title _____

Date of submission _____ Date of defense _____

Evaluation _____

Research Proposal Examination (by end of year 3)

Title _____

Date of submission _____ Date of defense _____

Evaluation _____

All requirements to advance to candidacy are fulfilled: Date _____

Thesis Committee signatures _____

Annual Review Committee

Date	Committee	Comments
Year 1		
Year 2		
Year 3		
Year 4		
Year 5		
Year 6		