Overview:
The MSE PhD qualifying examination serves two purposes:

- To evaluate a candidate’s ability to creatively identify, develop, present and defend, in an oral format, a research proposal that is unrelated to their current or prior research activities.
- To evaluate a candidate’s general competency in Materials Science and Engineering at a beginning graduate level as expressed in an oral format.

The QE will be comprised of a written proposal document, an oral defense of that document, and an oral exam of general materials science principles all evaluated by a committee of three MSE faculty members appointed by the department head. If the number of candidates becomes sufficiently large that all exams cannot be administered in two days, additional faculty committees will be formed. The committee members will change from semester to semester.

During the oral defense, the candidates are expected to answer questions regarding the written proposal technical content at the advanced graduate level (depth component). During the general principles portion of the oral exam, candidates are expected to answer questions from the committee addressing the fundamentals of Materials Science and Engineering. These questions will be asked at the introductory graduate level (breadth component).

Exam Scheduling: The MSE qualifier exam will be offered during the Fall and Spring semesters.

- During the Fall semester, all exams will be administered as close as is possible to the Tuesday through Friday immediately following Labor Day.
- During the Spring semester, all exams will be administered as close as is possible to the Tuesday through Friday immediately following Martin Luther King Day.
- Barring unforeseen circumstances, all qualifier exams will be given during these periods.

All candidates that wish to take the exam must notify the department via email to Edna Deas (edna_deas@ncsu.edu) on the Tuesday six weeks before Labor Day and Martin Luther King Day for the fall and spring semesters respectively. By 5:00 pm, candidates are required to submit:

- The title and an abstract (maximum 200 words) of their research proposal
- A brief abstract (200 words maximum) summarizing the candidate’s current thesis research (if a project has been selected)

The qualifier exam committee will review the submissions to ensure that the exam and thesis topics are sufficiently distinct. Feedback will be provided within one week in situations of excessive technical overlap.

The written component of the qualifying exam will be submitted by email to Edna Deas on the Tuesday at 5:00 pm two weeks before Labor Day and Martin Luther King Day for the fall and spring semesters respectively.
If after declaring intent to take the exam, a candidate decides not to do so, (s)he has a four-week window (ending at 5 pm on the Tuesday four weeks after the submission deadline) to petition in writing (or by email) their advisor and the department head for cancellation. With consent of both, the candidate will be allowed to cancel their examination without penalty. After the four-week window, barring extenuating circumstances, cancellations will not be allowed.

There is no requirement regarding the initial time of taking the qualifier exam, however, all MSE Ph.D. candidates must pass the qualifier exam by the end of their fifth semester. Failure to do so will disqualify a student from earning an NCSU Materials Science and Engineering Ph.D. degree.

GUIDELINES FOR THE QUALIFIER EXAM

The qualifier exam will be given within a 90 minute time slot during which the presentation, questions regarding the proposed research, and general Materials Science questions will be discussed. Candidates should expect that approximately 30 minutes be budgeted for each component.

Research proposal: Ph.D. candidates will prepare and defend a research proposal. The candidate, in consultation with their faculty advisor, selects the topic. The thesis advisor is charged to ensure that the topic:

- Addresses a scientific or technological problem of contemporary interest
- Is unique with respect to the student's thesis (or previous research)

To facilitate these outcomes, at the time of abstract submission, students are required to submit a summary of their thesis/research topic that identifies the distinction from their current or previous research.

The thesis advisor is encouraged to assist proposal preparation by screening (not editing) the proposal and providing recommendations regarding areas where improvement/modification is needed.

The proposal examination component is intended to test a critical skill set of Ph.D. candidates: the ability to self-learn and to creatively apply existing background knowledge when addressing a new research problem. To this effect, candidates are urged to focus their proposals and defenses on their approaches to problem solving, to clearly state the scientific or engineering hypotheses that underpin the proposed research, and to demonstrate how their plan of work enables critical hypothesis evaluation and test.

The written proposal must comply with the following guidelines:

- 5 page limit, including figures, not including references
- 1" margins, 12-point times new roman font, line spacing can be no tighter than to accommodate 6 lines per inch.
- The proposal must be submitted electronically to Edna Deas by 5:00 pm on the Tuesday one week before Labor Day and Martin Luther King Day for the fall and spring semesters respectively.

A well-structured proposal style similar to that requested by the National Science Foundation is encouraged. For example, a five-section format can be used:

- Section 1: Executive Summary
Proposal Defense: Candidates will prepare a presentation describing their research proposal. The candidates should structure this presentation such that it requires no more than 15 minutes if presented without interruption. During the presentation and afterwards the committee will ask questions that are intended to explore the technical and scientific aspects of the proposal, and aspects of its practical execution at the advanced graduate level.

General Questions: The Materials Science and Engineering qualifier oral examination will consist of a set of questions that represent a general knowledge of Materials Science and Engineering. The oral defense will follow immediately the proposal defense and will take approximately 30 minutes. The breadth of topics will include, but is not limited to, those covered in MSE 791: Structure Property Relations in Advanced Materials. (Note: The current course number, MSE 791, is temporary and will be replaced with a permanent 5XX number in the Fall 2012 semester.) The most recent syllabus content for MSE 791 is attached and may be used as a partial guideline for preparations.

**General questions are intended to identify and candidate’s ability to demonstrate a basic knowledge of Materials Science and Engineering principles in an oral format before an exam committee of three faculty. The examination topics and questions will focus on fundamentals of Materials Science and Engineering as opposed to technology.**

QUALIFIER EXAM EVALUATION

The qualifier committee will evaluate collectively the examinations after all have been completed.

The exam will be graded as three components: 1) written proposal, 2) proposal defense, and 3) oral examination. Each component will be graded as pass or fail. To pass the qualifier exam, each candidate must pass all three sections.

If any component of the qualifier exam is failed, the entire exam must be taken in a subsequent semester. The student may schedule the second attempt during any subsequent semester provided this attempt occurs before or during their fourth semester in graduate school at NCSU MSE. If the exam is taken a second time, the same research proposal topic, document, and presentation may be used. Alternatively, a new topic may be selected.

Feedback will accompany the exam decisions. The feedback will include areas of strengths and weaknesses and will become a component of the graduate file.
MSE 791: STRUCTURE PROPERTY RELATIONSHIPS IN ADVANCED MATERIALS

Instructor: Jon-Paul Maria

Prerequisites: Coursework in physics and chemistry consistent with bachelor’s degree in science or engineering

Office hours: TBA or by appointment (jpmaria@ncsu.edu, 919 513-2843)

Learning outcomes

Students completing this course should be able to:

► Relate the electronic structure of atoms to the structure of solids that comprise them
► Discuss, understand, and compare the aspects of chemical bonding in solids
► Identify the structure and chemistry of point, line, and planar defects in solids
► Read and interpret a unary and binary phase diagram
► Understand the crystalline lattice and the nomenclature used to describe it
► Discuss the properties associated with ceramic, semiconducting, metallic, and amorphous solids
► Understand the roles of thermodynamics and kinetics in determining properties and phase transitions

Textbook


Course overview

MSE 791 is a graduate level introduction to Materials Science and Engineering that focuses on structure property relationships across the broad spectrum of advanced materials of contemporary interest. The course is intended as an introduction for graduate students who are entering the field of materials research but have not completed a Materials Science and Engineering bachelor’s degree.

Course schedule (based on 28 75-minute classes)

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