

# AOSS Qualifying Exam

Approved by AOSS Faculty Meeting, Date:

## Objective

The objective of the AOSS qualifying exam is to assess whether a student is academically prepared to conduct research for the Ph.D. dissertation.

## Approach

The AOSS qualifying exam tests three specific qualities:

1. The student's ability to apply the fundamental methods of physical science in order to solve problems that address more than one traditional core course.
2. The student's ability to critically evaluate a selected research topic and relate it to important questions in the broader context of science and/or engineering.
3. The student's ability (in writing and orally) to communicate the technical concepts and technical details associated with scientific research.

In addition, the act of studying for the exam benefits the student by providing an opportunity to synthesize and assimilate the material from the core courses.

## Overview

To meet the objective described above, AOSS will use the combination of a written exam, a critical review of a modern research result, and an oral exam, conducted by AOSS faculty. The written exam is designed to test goal #1, the critical review responds to #2, and the oral exam covers all three goals. The written exam tests the application of the methods covered, for the most part, by AOSS core courses and program core courses. It is administered in early May. The topic of the research review is provided upon completion of the written exam, at least two weeks before the oral exam, which will be scheduled in late May. The oral exam starts with a 15-20 min report on the research topic. The oral exam focuses on: a) aspects related to this research topic; b) issues related to weaknesses uncovered during the written exam; and c) a broader science discussion. Each of the exams carries equal weight.

## Written Exam

**Description:** The written exam is a 4-hour, closed-book exam administered in a single classroom. The exam covers the methods and central content of the AOSS core courses and program core courses. The exam will have some questions that are common to all students and some questions that are distinct for space-planetary and atmosphere-climate programs. In order to accommodate the interdisciplinary scope of the department, the specialized part of the exam will include enough questions that each student can choose one question to skip. The Qualifying Exam Committee, constituted annually, will formulate the questions with assistance as needed from the AOSS faculty, and will evaluate the results of the written exam.

**Times:** The time and location of written exams are non-negotiable. The exams will take place during the first two weeks of May. Because the written exam is meant to be drawn from the material covered in the core classes, it is recommended that the student take the exam after they have taken all of the core classes. Student also must meet the required Grade Point Average of

6.0 in order to take the exam. Typically, this would be at the end of the second academic year. Exceptions can be made for students who would like to take this exam earlier or later, after consultation with the student's advisor.

## **Research Report**

**Description:** The research report focuses on one or two papers drawn from the recent literature. The papers are given to the students no later than two weeks before the time of the oral exam. The students are asked to critically review these papers and to assess their relevance beyond their immediate scientific discipline. The expected results are a) a written report no longer than five pages and b) an oral report lasting between 15 and 20 minutes at the beginning of the oral exam.

**Times:** The papers are given to the students no later than two weeks before the time of the oral exam. The research report is due to all committee members no later than 48 hours before the start of the oral exam. Late reports will be accepted only upon majority vote of the specific qualification committee.

## **Oral Exam**

**Description:** The oral exam consists of three parts. First, the students present the research report lasting 15-20 minutes. During this presentation, the papers are to be put into the broader context of the actual research in the scientific community. The report then critically analyzes the paper's conclusions in light of the assumptions and research methodology used. Second, the oral exam follows up on issues that surfaced during the written exam. The purpose of this exercise is to better understand the issues that surfaced during the written exam and to provide feed-back to the student. Third, the oral exam should encompass a broad scientific discussion that addresses questions beyond the specific report and/or the written exam.

**Times:** The times for oral exams are scheduled soon after the written exams, typically in late May. These times are non-negotiable. The duration of oral exams is to be open-ended, but they should last at least for 2 hours.

**Exam and grading process:** The oral examination committee (unique to each exam) conducts the oral exam and provides a recommendation to the graduate committee. The examination committee consists of the following members

- 1) 2 members of the Qualifying Exam Committee. One of these members chairs the committee.
- 2) 2 specialists from the AOSS faculty
- 3) 1 external faculty member (from another department)

The Ph.D. advisor does not participate in the oral exam of a given student. The committee fills out a comment sheet (Appendix A) as a consensus report.

## **Beyond the Qualifying Exam**

In order to receive a Ph.D. in AOSS at the University of Michigan, the student must complete the following tasks.

1. The student must form a dissertation committee according to the rules of the College of Engineering and the Department of AOSS.
2. The student must submit a 5-page description of their thesis topic to the graduate committee with signatures. There is no formal requirement on the format for this document, but it must be signed by all of the dissertation committee members.

3. The student must write a dissertation according to the rules of the College of Engineering, Rackham, and AOSS.
4. The student must defend the thesis according to the rules of the College of Engineering, Rackham, and AOSS.

## **Administrative**

**Qualifying Exam Committee:** The written exam, coordination of the research reports, and scheduling of the oral exams will be coordinated by a qualifying examination chair appointed by the department chair. The position will rotate among the faculty. A sufficient number of other members of the Qualifying Exam Committee will be appointed by the department chair to accommodate the number of oral exams anticipated in a given year.

**Advancement to Candidacy:** Evaluation of advancement to candidacy will take place following the oral exams, at a meeting involving the Graduate Committee, the Qualifying Exam Committee, and the Ph.D. advisor of the student. This evaluation will consider the performance of the student in coursework, on the written exam, on the oral exam, and in research. The intention is to advance to candidacy only those who have demonstrated to capacity to independently apply the principles and methods of physical science to the independent study of physical problems of interest. The Graduate Committee may conditionally advance students to candidacy, subject to further required coursework or other requirements.

**Students who do not advance to candidacy:** Those students who are not advanced to candidacy on the first attempt may either “fail with chance to re-take”, or “fail without chance to re-take”. Students who are not advanced to candidacy on the second attempt must leave the AOSS Ph.D. program. In all cases written feedback is to be returned to the student.

## **Appendix A: Examination Sheet**

Name of Candidate:

Answer the following questions with short comments and explanatory remarks.

### **Research Report and Presentation**

1. Is the research report clear and the science rationale sound?
2. Is the presentation adequate?
3. Is the report well referenced?
4. Can the candidate explain the reasoning in the paper and defend his or her own conclusions about the paper?
5. Can the candidate apply classroom knowledge to open-ended research questions?
6. Can the candidate reason conceptually and mathematically to address questions related to research?
7. Can the candidate see and explain broader applications of knowledge to research in neighboring fields?

Add comments on back of sheet, if necessary.