

# Graduate Programs Handbook

## Department of Mechanical and Aerospace Engineering

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## PREFACE

The *Graduate School Handbook* should be consulted for details regarding university rules and regulations relating to graduate students at The Ohio State University (Ohio State). The *Graduate School Handbook* can be located in its entirety on the Graduate School website: <https://gradsch.osu.edu/>. This handbook describes the policies and procedures relevant to the Department of Mechanical and Aerospace Engineering's (MAE) graduate programs at Ohio State in accordance to the policies outlined in the *Graduate School Handbook*.

The Department is home to three graduate programs: Aeronautical and Astronautical Engineering (AAE), Mechanical Engineering (ME) and Nuclear Engineering (NE). This handbook includes information pertaining to the academic and examination requirements for both the Master of Science (MS) and Doctor of Philosophy (PhD) degree paths in those three programs including the Qualifying Exams (QE) and Candidacy Exam (CE) when applicable. The MS and PhD program requirements that follow are set by the MAE Graduate Studies Committee (GSC) and consistent with the policies set by Graduate School at The Ohio State University.

We encourage both students and faculty to take the opportunity to review this handbook. Should any questions, comments or suggestions arise surrounding the content of this handbook, those requests can be addressed to the attention of the MAE GSC by way of the MAE Graduate Advising Office at [ENG-MAEGradProgram@osu.edu](mailto:ENG-MAEGradProgram@osu.edu).

## SECTION 1 – ADMISSION

### 1.1 GENERAL INFORMATION

The MAE GSC oversees the review of all applicants to the department. Applications are only accepted for the autumn and spring semesters. Applicants must complete the online application (<http://apply.osu.edu/grad>) and submit all required application materials by the published application deadline for the semester in which they wish to apply.

Students whose backgrounds are not in engineering, physics, or chemistry should strongly look into taking courses equivalent to Ohio State's core Undergraduate Mechanical Engineering or Aeronautical and Astronautical Engineering courses before applying for admission to the graduate program.

### 1.2 APPLICATION DEADLINES

The deadlines for admission are as follows:

*Autumn semester* – November 30 (deadline for Fellowship consideration)  
January 15 (all other funding consideration and general admission)

*Spring semester* – October 1<sup>1</sup>

### 1.3 UNIVERSITY ADMISSION CRITERIA

The Graduate School requires applicants to submit documentation that demonstrates fulfillment of the following admission criteria or equivalent qualifications as outlined by the Graduate School (Section 2.2, *Graduate School Handbook*):

1. an earned baccalaureate or professional degree from an accredited college or university by the expected date of entry
2. a minimum of a 3.0 cumulative point-hour ratio (on the 4.0 scale used at this university) in all previous undergraduate and graduate work
3. prerequisite training that will enable the student to pursue the graduate program to which admission is sought
4. A minimum score of 550 on the Paper-based (PBT) Test of English as a Foreign Language (TOEFL), 213 on the computer-based TOEFL (CBT), or 79 on the Internet-based (IBT) TOEFL. 82 is the minimum score allowed on the Michigan English Language Assessment Battery (MELAB), or 7.0 on the International English Language Testing System (IELTS). This requirement only applies to applicants from a country where the first language is not English, unless a bachelor's degree or higher was earned in an English-speaking country
5. Additional criteria published by the GSC of the local program

### 1.4 PROGRAM SPECIFIC ADMISSION CRITERIA

In addition to the admission criteria set forth by the Graduate School, the MAE graduate programs require the following application materials:

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<sup>1</sup> Applicants who apply for Spring semester admission consideration are eligible for funding consideration however most positions begin in the Autumn semester.

1. One set of official transcripts from all undergraduate and graduate institutions attended<sup>2</sup>
2. A one to two page statement of purpose
3. A one to two page résumé
4. Three letters of recommendation
5. Official GRE scores are required of all applicants *except* those who are currently enrolled as an undergraduate at Ohio State that are applying to the combined degree program.<sup>3</sup>
6. At least one of the following scores is *preferred* if English is not your native language: 96 on the Internet-based (IBT) TOEFL, 590 on the Paper-based (PBT), 243 on the computer-based TOEFL (CBT), 7.5 on the International English Language Testing System (IELTS), or an 82 on the Michigan English Language Assessment Battery (MELAB).
7. In cases where special conditions are imposed on admission, if these conditions are not met, the student may be dismissed from the program

## 1.5 COMBINED DEGREE ADMISSION

Students applying to the combined degree program must satisfy all of the application requirements outlined in sections 1.3 and 1.4 in addition to the following requirements:

1. Submit a *Combined Degree* form (available at <https://gradforms.osu.edu/grad-forms/form/enrollmentForms>) identifying the courses that you would like to double count for both your undergraduate and graduate degrees.
2. Submit an honor's undergraduate research proposal to the College of Engineering
3. Pursue honor's research in the Department of Mechanical and Aerospace Engineering

## 1.6 TRANSFERRING WITHIN OHIO STATE

Students requesting to transfer internally from within one graduate program at Ohio State to either the ME, AAE, or NE graduate programs will need to submit an Intra-University Transfer (IUT) application via the online application system (<http://apply.osu.edu/grad>). The student making the request will also need to submit a *Transfer of Graduate Program* form (available at <https://gradforms.osu.edu>).

If the MAE GSC Chair approves the transfer, he or she will specify the admission classification and the courses already completed that will count toward the student's graduate degree program. The MAE GSC Chair must notify the Graduate School of the admission classification and courses to count prior to the effective semester of transfer. Graduate School Fellowships do not automatically transfer with students who are approved for transfer into a different graduate program but such a

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<sup>2</sup> Students who earned their undergraduate degree from Ohio State are not required to obtain official transcripts for their completed coursework here as it will be obtained through internal processes once an application is submitted. If a student transferred into Ohio State or has taken any classes for undergraduate or graduate credit from a different university, a transcript for each institution attended, aside from Ohio State, must be received directly by Ohio State's Graduate Admissions Office in order to be eligible for admission consideration.

<sup>3</sup> Though not required for admission to the combined degree program, students pursuing that opportunity are strongly encouraged to report official GRE scores to Ohio State so they will be eligible for consideration in the University Fellowship competition.

request could be considered in extenuating circumstances. Qualifying Exam results and Candidacy Exam results do not transfer to a new graduate program.

**Intradepartmental Transfer Requests.** In addition to the IUT application and the Transfer of Graduate Program form, and providing the student is in good academic standing within MAE, a letter of support from the person serving as the faculty advisor in the new program in MAE is required to initiate a transfer request.

Students who request to transfer internally within MAE and are unable to provide a letter of support from a faculty advisor will be viewed as a new applicant to the graduate program in which they are seeking admission and they will be required to submit a statement of purpose, valid GRE scores (taken within the last 5 years) and three letters of recommendation before their transfer request will be reviewed.

**Interdepartmental Transfer Requests.** Students requesting to transfer from a graduate program outside of MAE into the ME, AAE, or NE graduate program will be viewed as a new applicant to the graduate program in which they are seeking admission and they will be required to submit a statement of purpose, valid GRE scores (taken within the last 5 years) and three letters of recommendation before their transfer request will be reviewed.

**Graduate Non-Degree Credit Transfer Requests.** If a graduate non-degree student is admitted to a graduate degree program, no more than seven (7) hours of semester graduate credit accumulated while in this non-degree classification may be counted toward the graduate degree (Section 2.4, *Graduate School Handbook*). Students requesting to transfer credit from courses they have completed as part of the Graduate Non-Degree Program at Ohio State must submit a Transfer of Graduate Credit form (available at <https://gradforms.osu.edu>) within their first semester of enrollment in their degree seeking program. Non-Degree credit transfer requests are subject to review and approval of the MAE GSC Chair and the Graduate School.

## 1.7 TRANSFERRING FROM OUTSIDE OF OHIO STATE

Students requesting to transfer from a graduate program at an institution other than OSU will need to submit an application via the online application system (<http://apply.osu.edu/grad>). The applicant seeking the transfer will need to submit all of the required application materials (*sections 1.3 and 1.4*).

Students requesting to transfer any credit from another institution to Ohio State must submit a Transfer of Graduate Credit form (available at <https://gradforms.osu.edu>). If a student is pursuing a Doctoral degree at Ohio State and has received a Master's degree at another institution it must be transferred to Ohio State (Section 7.1, *Graduate School Handbook*). Any request to transfer credit hours into Ohio State should be completed within the student's first semester of enrollment in their program. All credit transfer requests are subject to review and approval of the MAE GSC Chair and the Graduate School.

**Transferring Course Credit into a MS program.** Students requesting to transfer credit into a MS degree program in MAE must complete 80% of the MS course work at Ohio State. As such, MS students can transfer a maximum of 6 hours of course credits from another university. The courses transferred must have been taken as a graduate student, must be designated as graduate courses and be identified on the transcript as such. A grade of at least a B must have been earned for the course credit to be transferred and used to fulfill a MS degree requirement.

**Transferring Course Credit into a PhD program.** Students requesting to transfer credit completed from a PhD program at another university, either individually or who have been recruited to work with a current Ohio State faculty member, are allowed to transfer a maximum of 9 credit hours of letter graded graduate course credit to the PhD program at Ohio State. Any student

transferring into a PhD program in AAE, ME, or NE is also required take the Qualifying Exam and Candidacy Exam in their respective program while enrolled at Ohio State.

Students requesting to transfer credit from a PhD program at another university and who are entering with a new Ohio State Faculty Member are eligible to transfer all of their previous graduate coursework however the following requirements must be met:

- A minimum of 24 credit hours must be completed at Ohio State
- At least one letter-graded course must be completed at Ohio State to establish a GPA
- Qualifying Exam must be taken at Ohio State<sup>4</sup>
- Candidacy Exam must be taken at Ohio State

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<sup>4</sup> If the student has completed the Qualifying Exams at another university a petition can be submitted requesting exemption from the OSU MAE Qualifying Exams. The petition must include documentation from the previous institution showing successful completion of the Qualifying Exams.

## SECTION 2 – REGISTRATION AND ACADEMIC REQUIREMENTS

### 2.1 MINIMUM REGISTRATION REQUIREMENTS

Students are expected to register every semester they are pursuing a graduate degree in MAE at Ohio State. The minimum registration requirements per semester, including the program specific seminar (if applicable) and research credits, are as follows:

1. Eight (8) credit hours during the autumn and spring semesters is required to be full-time for the following student populations:
  - U.S. citizens,
  - Permanent residents,
  - International students, or
  - Students holding a 50 percent Graduate Associate position
2. Twelve (12) credit hours during the autumn and spring semesters is required to be full-time for all Fellowship (i.e., university fellowships or other fellowships and scholarships) and GRA-GS Match students.
3. Three (3) credit hours is required to be full-time for PhD students during the autumn and spring semesters following admission to Candidacy (i.e. passed the Candidacy Exam).
4. Students who enrolled but who are not full-time students (i.e. those who do not satisfy any of the previous enrollment criteria) would be considered a part-time student.

**Summer Registration.** Enrollment in the Summer term is optional except in instances where the student is planning to graduate in which case three (3) credit hours is the minimum number of hours required in order to graduate. Four (4) credit hours is required to be full-time for students who hold a 50 percent Graduate Associate position, a Summer Fee Authorization or who are self-supporting. Six (6) credit hours is considered full-time for Fellowship students and GRA-GS Match students.

**Graduation Semester Registration.** Three (3) credit hours is the minimum number of hours required in the expected semester of graduation, however any student who is appointed as a GA, Fellow or GRA-GS Match will need to satisfy the full-time enrollment requirements consistent with their appointment to maintain their appointment and benefits.

**Failure to Enroll.** Students who fail to enroll in a given semester (with the exception of summer term, where enrollment is optional) will lose the ability to register for future semesters and they will be placed on a leave of absence by the university. Students placed on a leave of absence by the university will not be able to enroll until they have sought to be reactivated.

**Reactivation.** Students who have not completed their intended graduate degree are eligible to seek reactivation back into the program such that they can complete their degree.

Students who have been gone for one to four semesters can seek reactivation by completing a *Permission to Reactivate Enrollment Eligibility* form (available at <http://go.osu.edu/gradreactivation>) and submit it to the MAE Graduate Advising Office. Students are also strongly encouraged to submit a tentative plan for degree completion to their advisor and obtain their advisor's concurrence before submitting the reactivation form. This is to ensure both student and advisor are on the same page in seeing the degree through to completion.

Students who have been gone for more than four semesters are subject to review and approval of the MAE GSC. In order to be eligible for reactivation, students who haven't been enrolled in the last four semesters are required to complete the following:

- submit a tentative plan for degree completion to the person who will serve as your faculty advisor and obtain their approval of your plan.
- complete a *Permission to Reactivate Enrollment Eligibility* form (available at <http://go.osu.edu/gradreactivation>) and submit it to the MAE Graduate Advising Office along with your plan for degree completion that has been approved by your faculty advisor.

## 2.2 MAXIMUM REGISTRATION ALLOWED

The maximum number of hours permitted by the Registrar's Office is 18 credit hours per semester or 12 credit hours in summer term.

## 2.3 REASONABLE PROGRESS

To be in good academic standing in the Graduate School, a student must maintain a cumulative point-hour ratio (CPHR) of 3.0 or higher in all graduate credit courses and must maintain reasonable progress toward the degree requirements, including research activities.

Students can be cited for a lack of reasonable progress at any point if they are not making satisfactory progress toward their graduate degree. No student may be denied further registration in a graduate program without first being warned by the Graduate School that such action may take place. The Graduate School specifies the conditions the student must satisfy in order to demonstrate reasonable progress and to continue enrollment in the graduate program. Conditions consist of completion of course work or other requirements as approved by the GSC (Section 5.4, *Graduate School Handbook*). A student who has been warned that further registration in the graduate program may be denied and who then satisfies the specified conditions is placed in good standing by the Graduate School.

Examples of a lack of reasonable progress include but are not limited to:

- Not meeting any departmental conditions placed upon you;
- Changing faculty advisors more than twice over the course of your current degree plan;
- Receiving a "U" in any research credits for which you are enrolled;
- Failure of all three individual subject exams on the first QE attempt (*ME and AAE students only*);
- Two unsatisfactory attempts at passing three individual subject exams over two QE attempts;
- Two unsatisfactory attempts at the candidacy examination (Section 5.1, *Graduate School Handbook*);
- Two unsatisfactory attempts at the final oral examination (Section 5.1, *Graduate School Handbook*); or

- Failure to submit a final, completed copy of one's dissertation within one semester completing the final oral examination

Students who are deemed to not be in good academic standing can have their registration in future semesters blocked and could be subject to dismissal from their graduate program per Graduate School rules (Section 5.4 *Graduate School Handbook*).

## **2.4 COURSES FOR GRADUATE CREDIT**

Courses that count for graduate credit must be 5000-level and above with one exception; 4000-level courses outside of the students' own program can count for graduate credit but they must be designated by the Graduate School as approved for graduate credit and approved by the students' faculty advisor. No courses 3000-level or below and no 4000-level courses or below in the student's own program may be counted for graduate credit. A complete course catalog and schedule of classes can be found online at [www.buckeyelink.osu.edu](http://www.buckeyelink.osu.edu).

## **2.5 MINIMUM GRADE REQUIREMENT**

For courses completed during Spring 2018 or in the semesters that follow students must earn a grade of C or better for it to be used to satisfy their program's course requirements. While a course in which a grade of C- or lower is earned will not fulfill a MAE program requirement, the course grade will be calculated in the student's CPHR and will appear on the student's transcript.

## **2.6 CODE OF STUDENT CONDUCT**

Students are expected to abide by the Code of Student Conduct while they are pursuing a graduate degree in the Department of Mechanical and Aerospace Engineering. The Code of Student Conduct can be found in its entirety at <https://studentlife.osu.edu/csc/>.

## SECTION 3 – ADVISING

### 3.1 FACULTY ADVISOR FUNCTIONS AND SELECTION

Selecting a faculty advisor is probably one of the single most important decisions students will make during the course of their graduate career. Faculty advisors will assist the student in planning their graduate degree program. It is important that students take their time when choosing their advisor because he or she will be a key component in the student's success at the graduate level. Faculty advisors will approve, supervise, and evaluate individual work performed by a student to fulfill the requirements for a MS Thesis, MS Non-Thesis, or a PhD. Faculty advisors will also assist a student in making arrangements for their required degree examinations. It is the joint responsibility of an adviser and a student to complete a degree program in a reasonable period of time.

It is important to be aware that master's and doctoral students have different criteria when selecting an advisor and those criteria are as follows:

- **Master's advising status** – Faculty must hold membership at the **Category M (M-status)** level or higher in the student's graduate program
- **Doctoral advising status** – Faculty must hold membership at the **Category P (P-status)** level in the student's graduate program

The Graduate School sets the minimum qualifications for faculty to hold advising status in a program (Section 12.4, *Graduate School Handbook*) however advising status is granted at the discretion of the individual programs. In addition to the faculty whose home unit is MAE, students can seek a faculty advisor outside of the MAE department. Students interested in this option should consult with the MAE Graduate Advising Office.

Students are strongly encouraged to choose an advisor, through mutual consent, as soon as possible. Students are required to select an advisor and notify the MAE Graduate Advising Office of their advisor by the end of their second semester of enrollment in the graduate program. If an advisor has not been selected by the end of the student's first two semesters of graduate study, the student can be denied from further registration until an advisor has been selected.

Once a faculty advisor has been selected, students must report their faculty advisor to the MAE Graduate Advising Office via the *Graduate Student Milestone Notification* form (<https://go.osu.edu/mae-gsmn>). Faculty advisors will be required to confirm their status as the student's advisor before that information will officially be added to the student's record.<sup>1</sup>

**Changing Faculty Advisors.** Once a faculty advisor has been reported to the MAE Graduate Advising Office, students who wish to change their advisor will be required to submit a new *Graduate Student Milestone Notification* form identifying the former advisor and the new advisor. The change will be processed once the new advisor confirms their status as the student's new advisor.

Any student who changes their faculty advisor more than two times over the course of their current degree plan will be prohibited from further enrollment due to a lack of academic progress. In order to continue enrollment, students will need to meet with the MAE GSC Chair to discuss their continued enrollment in the program. Students can seek reinstatement after a plan for finishing the intended degree is provided in writing and they have received approval from the GSC Chair to re-enroll.

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<sup>1</sup> Students who secure an advisor at the time of their admission are not required to submit the *Graduate Student Milestone Notification* as that information will be added to their student record at the start of their first semester in their graduate program.

## 3.2 REQUESTS TO CHANGE DEGREE LEVEL

Students can request to change their intended graduate degree level (MS → PhD or PhD → MS) in AAE, ME or NE at any point during their graduate studies. Students who wish to change their degree level in their current program must have an advisor on record and they must submit a change in degree level request via the *Graduate Student Milestone Notification* form (<https://go.osu.edu/mae-gsmn>). For changing from PhD to MS, faculty advisor approval is not required, however the advisor will be notified. Student's should consult with the MAE Graduate Advising Office to determine if there are other implications to making this change, particularly if they are a GRA or GTA. For changing from MS to PhD, the student must have a faculty member who agrees to be their advisor for the PhD. If a faculty advisor is not found, the student must reapply to the department for consideration as a PhD applicant.

## 3.3 PETITIONS

Special requests with regards to any AAE, ME or NE requirements will be considered when initiated by the student via petition. Students seeking to submit a petition can do so via the *Graduate Student Milestone Notification* form (<https://go.osu.edu/mae-gsmn>). The student's faculty advisor will be required to provide a brief statement of support for the petition before any such requests will be considered. Both the student and the faculty advisor will be notified of the result of the petition when a decision is available.

## 3.4 GRADUATE STUDENT EVALUATIONS

In consultation with their faculty advisor, all students are required to complete a *Graduate Student Evaluation* form annually with their faculty advisor. Students who do not have a faculty advisor at the time the evaluations are due are required to meet with the MAE Graduate Advising Office and acquire a graduate academic advisor's approval prior to submitting their evaluation. Upon completing the evaluation, a copy must be submitted to the MAE Graduate Advising Office for the program and degree the student is currently pursuing by the end of the Spring semester each year they are enrolled in the program. The evaluation must be signed by both the student and the student's faculty advisor (or graduate academic advisor, when applicable) prior to submitting it to the MAE Graduate Advising Office.

## SECTION 4 – MASTER OF SCIENCE DEGREE PROGRAMS

### 4.1 MASTER OF SCIENCE DEGREE REQUIREMENTS

In order to graduate with a Master of Science degree (MS) in AAE, ME or NE, students must meet all requirements established by their respective program (as outlined in this handbook) and the University (Section 6.6, *Graduate School Handbook*) for the specific degree path they are pursuing. A minimum of 30 credit hours, including course work and a satisfactory thesis or non-thesis project is required to obtain a MS degree. The entire work for the MS degree must be completed within a period of six calendar years. The specific requirements for both the thesis and non-thesis paths are outlined in this section.

Aeronautical and Astronautical Engineering	
Thesis	Non-Thesis
<ul style="list-style-type: none"> <li>• 18 total hours of letter graded graduate courses                             <ul style="list-style-type: none"> <li>○ At least 3 hours must be 4000+ Math (except Math 4504), 5000+ Stats, or other program approved math equivalency courses</li> <li>○ At least 9 hours must be 5000+ MAE courses</li> <li>○ At least 6 hours must be 6000+ courses</li> </ul> </li> <li>• At least 12 hours of AAE 8998 (<i>Graduate Research in Aerospace Engineering</i>) with your faculty advisor</li> <li>• Satisfactory completion of a MS thesis document and oral thesis defense</li> <li>• 3 hours of AAE 8890 (<i>Aerospace Engineering Graduate Seminar</i>)</li> </ul>	<ul style="list-style-type: none"> <li>• 27 total hours of letter graded graduate courses                             <ul style="list-style-type: none"> <li>○ At least 3 hours must be 4000+ Math (except Math 4504), 5000+ Stats, or other program approved math equivalency courses</li> <li>○ At least 12 hours must be 5000+ MAE courses</li> <li>○ At least 12 hours must be 6000+ courses</li> </ul> </li> <li>• At least 3 hours of AAE 8998 (<i>Graduate Research in Aerospace Engineering</i>) with your faculty advisor</li> <li>• Satisfactory completion of a Special Research Topic with final exam or report</li> <li>• 3 hours of AAE 8890 (<i>Aerospace Engineering Graduate Seminar</i>)</li> </ul>

Mechanical Engineering	
Thesis	Non-Thesis
<ul style="list-style-type: none"> <li>• 18 total hours of letter graded graduate courses                             <ul style="list-style-type: none"> <li>○ At least 3 hours must be 4000+ Math (except Math 4504), 5000+ Stats, or other program approved math equivalency courses</li> <li>○ At least 9 hours must be 5000+ MAE courses</li> <li>○ At least 6 hours must be 6000+ courses</li> </ul> </li> <li>• At least 12 hours of ME 8998 (<i>Graduate Research in Mechanical Engineering</i>) with your faculty advisor</li> <li>• Satisfactory completion of a MS thesis document and oral thesis defense</li> <li>• ME 8888 (<i>Mechanical Engineering Graduate Seminar</i>) every semester until graduation</li> </ul>	<ul style="list-style-type: none"> <li>• 27 total hours of letter graded graduate courses                             <ul style="list-style-type: none"> <li>○ At least 3 hours must be 4000+ Math (except Math 4504), 5000+ Stats, or other program approved math equivalency courses</li> <li>○ At least 12 hours must be 5000+ MAE courses</li> <li>○ At least 12 hours must be 6000+ courses</li> </ul> </li> <li>• At least 3 hours of ME 8998 (<i>Graduate Research in Mechanical Engineering</i>) with your faculty advisor</li> <li>• Satisfactory completion of a Special Research Topic with final exam or report</li> <li>• ME 8888 (<i>Mechanical Engineering Graduate Seminar</i>) every semester until graduation</li> </ul>

<b>Nuclear Engineering</b>	
<b>Thesis</b>	<b>Non-Thesis</b>
<ul style="list-style-type: none"> <li>• Completion of the core NE courses               <ul style="list-style-type: none"> <li>○ Math 4512 (<i>Partial Differential Equations for Sci. and Eng.</i>) or an equivalent course</li> <li>○ NE 5606 (<i>Radiation Protection and Shielding</i>)</li> <li>○ NE 5742 (<i>Nuclear Radiations and Their Measurements</i>)</li> <li>○ NE 6536 (<i>Nuclear Reactor Systems and Analysis</i>)</li> <li>○ NE 6708 (<i>Reactor Theory</i>)</li> <li>○ NE 6725 (<i>Nuclear Reactor Dynamics</i>)</li> <li>○ NE 6726 (<i>Reactor Dynamics Laboratory</i>)</li> <li>○ NE 6766 (<i>Nuclear Engineering Design</i>)</li> </ul> </li> <li>• 3 hours of 5000+ NE coursework beyond the core courses</li> <li>• Any remaining hours needed in order to reach the minimum of 30 graduate hours required by the Graduate School can be NE 8998 (<i>Graduate Research in Nuclear Engineering</i>) and/or additional graduate level coursework</li> <li>• Satisfactory completion of a MS thesis document and oral thesis defense</li> <li>• NE 6881 (<i>Nuclear Engineering Seminar</i>) every semester until graduation</li> </ul>	<ul style="list-style-type: none"> <li>• Completion of the core NE courses               <ul style="list-style-type: none"> <li>○ Math 4512 (<i>Partial Differential Equations for Sci. and Eng.</i>) or an equivalent course</li> <li>○ NE 5606 (<i>Radiation Protection and Shielding</i>)</li> <li>○ NE 5742 (<i>Nuclear Radiations and Their Measurements</i>)</li> <li>○ NE 6536 (<i>Nuclear Reactor Systems and Analysis</i>)</li> <li>○ NE 6708 (<i>Reactor Theory</i>)</li> <li>○ NE 6725 (<i>Nuclear Reactor Dynamics</i>)</li> <li>○ NE 6726 (<i>Reactor Dynamics Laboratory</i>)</li> <li>○ NE 6766 (<i>Nuclear Engineering Design</i>)</li> </ul> </li> <li>• 6 hours of 5000+ NE coursework beyond the core courses</li> <li>• Any remaining hours needed in order to reach the minimum of 30 graduate hours required by the Graduate School can be NE 8998 (<i>Graduate Research in Nuclear Engineering</i>) and/or additional graduate level coursework</li> <li>• Satisfactory completion of a Special Research Topic with final exam or report</li> <li>• NE 6881 (<i>Nuclear Engineering Seminar</i>) every semester until graduation</li> </ul>

**Mathematics Requirement.** Courses taken to fulfill the mathematics requirement *cannot* be used to satisfy the other letter graded graduate coursework requirements. A listing of suggested Math, Stats, or Math-equivalent courses can be found in Appendix II of this handbook.

**6000-Level Coursework Requirement.** Unless used for mathematics credit, 6000-level and above AAE or ME courses can be used to fulfill the program specific course requirements for those programs and, at the same time, fulfill the 6000-level and above course requirement for students seeking a Master's degree. Students that use 6000-level and above courses to satisfy both the program specific course requirement and the 6000-level and above course requirement still must take enough approved graduate-level courses to fulfill the minimum amount of letter graded graduate coursework for their intended Master's degree.

**NE Core Courses.** Students who have completed the NE core courses or an equivalent course prior to joining the NE graduate program are not required to complete those courses again once enrolled as a graduate student in the NE graduate program at Ohio State. Students seeking an exemption from the NE core courses are required to submit a course plan to the MAE Graduate Advising Office showing how they plan to meet the minimum graduate credit hour requirement of 30 hours set by the Graduate School. In order to be acceptable to meet graduation requirements, the course plan must be approved by the student's faculty advisor, the Nuclear Engineering faculty, and the MAE GSC Chair.

## 4.2 CHOOSING THE THESIS OR NON-THESIS PATH

**Thesis Path.** The MS thesis path is intended for students who anticipate that research will be a major aspect of their career. It provides an opportunity to conduct independent research outside of the classroom under the able advisement of an expert in the field. The thesis path is ideal for students who plan to obtain a PhD at the completion of their MS.

Under the thesis path, an acceptable thesis must be submitted based upon individual research supervised by the student's faculty advisor. It is the student's responsibility to develop an acceptable research topic in consultation with his/her advisor. A final oral examination must also be passed. This examination will stress the thesis but may range over the academic work of the student.

Any student who is currently supported through the MAE Department via a graduate associate position (GRA, GTA, GAA, or GRA-GS Match) or any fellowship or scholarship that provides a fee authorization is expected to complete a thesis.

**Non-Thesis Path.** The MS non-thesis path is ideal for students who do not anticipate that research will be a major aspect of their career and do not plan to continue onto a PhD program. In addition to an increased number of courses required, the student must undertake a special project under the direction of their faculty advisor, leading to a final written exam or report. The final exam must be at least 4 hours long and the format could include a set of research problems, or a formal report on any topic acceptable to the student's advisor. An oral examination is optional and is at the discretion of the MS Examination Committee composed of two faculty with M-status.

Although not precluded, it is expected that students pursuing the non-thesis path will not be supported by GRAs, GTAs or fellowships.

## 4.3 APPLYING TO GRADUATE

Students planning to graduate in a given semester must submit an *Application to Graduate* (available at <https://gradforms.osu.edu>) and a *Graduation Checkout* (via <https://go.osu.edu/mae-gsmn>) by no later than the first Friday of the semester in which they intend to graduate. The *Application to Graduate* is subject to approval by the student's advisor, the MAE Graduate Advising Office, and the Graduate School.

**MS Examination Committee.** Students pursuing a MS degree must have a MS Examination Committee which consists of at least two members of the graduate faculty, one of whom will be the student's faculty advisor who will also serve as the chair of the committee. At least half of the members on the MS Examination Committee must have advising status in the student's graduate program (Section 3.1). The MS Examination Committee must be reported at the time an *Application to Graduate* is submitted.

Additional committee members may be added to a Master's Examination Committee at the discretion of the GSC Chair (Section 6.2, *Graduate School Handbook*). To add an external (non-OSU faculty) member to the MS Committee, the student must initiate a *Committee and Examination Petition* (available at <https://gradforms.osu.edu>). The request to add an external member to the MS Committee is subject to review by the student's faculty advisor and the GSC Chair. If approved, the petition is reviewed by the Graduate School for a final decision and the student will be notified of the result.

To make any changes to the membership of the MS Committee once the *Application to Graduate* has been submitted to the Graduate School, the student must initiate a *Committee and Examination Petition* (available at <https://gradforms.osu.edu>). The request is subject to review by

the student's faculty advisor and the GSC Chair. If approved, the petition is reviewed by the Graduate School for a final decision and the student will be notified of the result.

#### 4.4 MASTER'S EXAMINATION

The Master's examination is a test of the student's knowledge of the field of Aeronautical and Astronautical, Mechanical or Nuclear Engineering. It is the final validation of performance for the MS degree. The Master's examination is taken after submitting the *Application to Graduate* and during the semester in which the student plans to graduate. A student must be registered for at least three credit hours during the semester the Master's examination is taken.

**Thesis Option.** Below are details regarding the Master's examination for students pursuing the thesis option:

- The master's examination for a student pursuing the thesis option must include an oral portion and may include a written portion. The master's examination need not be confined to the thesis topic.
- The oral portion of the Master's examination emphasizes both an exposition and defense of the thesis investigation and a test of the candidate's knowledge of the course of study pursued.
- The examination is normally one hour in duration and should not exceed two hours.
- The examination must include a general presentation by the student which is open to visitors, followed by the actual thesis defense, which is limited to the MS Examination Committee and the student.

**Non-Thesis Option.** Below are details regarding the Master's examination for students pursuing the non-thesis option:

- The master's examination for a student pursuing the non-thesis option must include a written portion and may include an oral portion. The written portion may be in the form of an examination (in which case it should be at least four hours in length) or a substantial paper or project appropriate to the discipline and consistent with best practices in the field (Section 6.2, *Graduate School Handbook*).
- The oral portion, if selected, will test the range of the candidate's knowledge of the course of study pursued and may include a presentation of the results of the formal research paper. The oral portion must take place during announced university business hours, Monday through Friday.

**Results of the Master's Examination.** The committee's decision on the Master's examination, for both thesis and non-thesis students, is recorded on The Graduate School's *Report on Final Examination* form. Approval of the thesis is indicated on the *Report on Final Document* form. These forms are created after the student's *Application to Graduate* has been approved by the student's advisor, the MAE Graduate Advising Office and the Graduate School. These forms can be accessed by the advisor and OSU committee members at <https://gradforms.osu.edu>. External committee members will be sent a link to access the report forms.

#### 4.5 PURSUING A PHD AFTER COMPLETING A MASTER'S DEGREE

When submitting the *Graduation Checkout* students must indicate that they will be pursuing a PhD at Ohio State immediately following the completion of the MS degree. The faculty member with whom the student would like to work will also be asked to approve of the request. If the faculty

member approves and agrees to be their advisor, the student will be admitted to the PhD degree in the same program as their MS degree for the semester immediately following the completion of their MS.

Students who were admitted through the general admission process and who graduate with a MS degree but do not immediately pursue a PhD program in MAE in the following semester are still eligible to pursue a PhD at a later date. If a student has been gone more than one semester upon receiving a MS degree, he or she must request reactivation into the graduate program in order to pursue a PhD. In order to request reactivation, the student must complete a *Permission to Reactivate Enrollment Eligibility* form (available at <http://go.osu.edu/gradreactivation>) and that form should be submitted to [ENG-MAEGradProgram@osu.edu](mailto:ENG-MAEGradProgram@osu.edu) for processing. In addition to the reactivation request, the student will also be required to provide a letter of support from the faculty member with whom they would like to pursue their PhD confirming their plans for the student.

Students who graduate with a MS degree and who were admitted as part of a company partnership (GE, Honda, etc.) and are no longer supported by that company and plan to pursue a PhD must submit the following documents to be eligible to pursue a PhD:

- A one to two page statement of purpose
- A one to two page résumé
- Three letters of recommendation
- Official GRE scores
- If the student was not enrolled in the previous semester, he or she must complete a reactivation form and submit it to the MAE Graduate Advising Office.

All students who wish to pursue a PhD and are seeking to be reactivated into a PhD program after completing a MS degree are subject to GSC Chair review.

## SECTION 5 – DOCTORAL DEGREE PROGRAMS

### 5.1 DOCTORAL DEGREE REQUIREMENTS

In order to graduate with a Doctoral degree (PhD) in AAE, ME or NE, students must meet all requirements established by their respective program (as outlined in this handbook) and the University (Section 7.13, *Graduate School Handbook*) for the specific degree path they are pursuing. There are two potential paths for students pursuing a PhD: a BS-PhD path and a MS-PhD path. Students on the BS-PhD path begin work toward a Doctoral degree directly after receiving a baccalaureate degree and acceptance as a PhD student. Students on the MS-PhD path begin work toward a Doctoral degree after receiving a Master's degree.<sup>1</sup>

A minimum of 80 graduate credit hours beyond the baccalaureate degree, including coursework and a dissertation, are required to obtain a doctoral degree in the AAE, ME or NE graduate programs. If a student has obtained a Master's degree at Ohio State or elsewhere, then a minimum of 50 graduate credit hours beyond the Master's is required. If a student is pursuing a Doctoral degree at Ohio State and has received a Master's degree at another institution it must be transferred to Ohio State (Section 7.1, *Graduate School Handbook*). The entire work for the PhD degree must be completed within a period of nine calendar years. The specific requirements for both the BS-PhD and MS-PhD paths are outlined in this section.

<b>Aeronautical and Astronautical Engineering</b>	
<b>BS-PhD</b>	<b>MS-PhD</b>
<ul style="list-style-type: none"> <li>• 30 total hours of 5000+ letter graded graduate courses               <ul style="list-style-type: none"> <li>○ At least 3 hours must be 5000+ Math, Stats, or other program approved math equivalency courses</li> <li>○ At least 18 hours must be 6000+ courses and at least 9 of those hours must be MAE courses</li> </ul> </li> <li>• At least 50 hours of AAE 8999 (<i>Aerospace Engineering Research for Dissertation</i>) with your faculty advisor</li> <li>• 4 hours of AAE 8890 (<i>Aerospace Engineering Graduate Seminar</i>)</li> <li>• First author journal submission</li> </ul>	<ul style="list-style-type: none"> <li>• 18 total hours of 5000+ letter graded graduate courses               <ul style="list-style-type: none"> <li>○ At least 3 hours must be Math, Stats, or other program approved math equivalency courses</li> <li>○ At least 9 hours must be 6000+ MAE courses</li> <li>○ OSU MAE MS graduates can double-count up to 2 courses from their MS degree toward their PhD coursework requirements.</li> </ul> </li> <li>• At least 32 hours of AAE 8999 (<i>Aerospace Engineering Research for Dissertation</i>) with your faculty advisor</li> <li>• 2 hours of AAE 8890 (<i>Aerospace Engineering Graduate Seminar</i>)</li> <li>• First author journal submission</li> </ul>

<sup>1</sup> A student who starts on the BS-PhD path and later decides stop pursuing a PhD can apply all previously completed coursework toward a master's degree.

## Mechanical Engineering

<b>BS-PhD</b>	<b>MS-PhD</b>
<ul style="list-style-type: none"> <li>• 30 total hours of 5000+ letter graded graduate courses                             <ul style="list-style-type: none"> <li>○ At least 3 hours must be 5000+ Math, Stats, or other program approved math equivalency courses</li> <li>○ At least 18 hours must be 6000+ courses and at least 9 of those hours must be MAE courses</li> </ul> </li> <li>• At least 50 hours of ME 8999 (<i>Mechanical Engineering Research for Dissertation</i>) with your faculty advisor</li> <li>• ME 8888 (<i>Mechanical Engineering Graduate Seminar</i>) every semester until Candidacy</li> <li>• First author journal submission</li> </ul>	<ul style="list-style-type: none"> <li>• 18 total hours of 5000+ letter graded graduate courses                             <ul style="list-style-type: none"> <li>○ At least 3 hours must be Math, Stats, or other program approved math equivalency courses</li> <li>○ At least 9 hours must be 6000+ MAE courses</li> <li>○ OSU MAE MS graduates can double-count up to 2 courses from their MS degree toward their PhD coursework requirements.</li> </ul> </li> <li>• At least 32 hours of ME 8999 (<i>Mechanical Engineering Research for Dissertation</i>) with your faculty advisor</li> <li>• ME 8888 (<i>Mechanical Engineering Graduate Seminar</i>) every semester until Candidacy</li> <li>• First author journal submission</li> </ul>

## Nuclear Engineering

<b>BS-PhD</b>	<b>MS-PhD</b>
<ul style="list-style-type: none"> <li>• Completion of the core NE courses                             <ul style="list-style-type: none"> <li>○ Math 4512 (<i>Partial Differential Equations for Sci. and Eng.</i>) or an equivalent course</li> <li>○ NE 5606 (<i>Radiation Protection and Shielding</i>)</li> <li>○ NE 5742 (<i>Nuclear Radiations and Their Measurements</i>)</li> <li>○ NE 6536 (<i>Nuclear Reactor Systems and Analysis</i>)</li> <li>○ NE 6708 (<i>Reactor Theory</i>)</li> <li>○ NE 6725 (<i>Nuclear Reactor Dynamics</i>)</li> <li>○ NE 6726 (<i>Reactor Dynamics Laboratory</i>)</li> <li>○ NE 6766 (<i>Nuclear Engineering Design</i>)</li> <li>○ NE 7865 (<i>Neutron Slowing Down and Thermalization</i>)</li> </ul> </li> <li>• Three additional nuclear engineering courses 5000-level or above are required</li> <li>• Two additional Math courses or one Math and one Stats course 5000-level or above are required</li> <li>• NE 8999 (<i>Nuclear Engineering Research for Dissertation</i>)</li> <li>• NE 6881 (<i>Nuclear Engineering Seminar</i>) every semester until Candidacy</li> <li>• First author journal submission</li> </ul>	<ul style="list-style-type: none"> <li>• Completion of the core NE courses or equivalent coursework                             <ul style="list-style-type: none"> <li>○ Math 4512 (<i>Partial Differential Equations for Sci. and Eng.</i>) or an equivalent course</li> <li>○ NE 5606 (<i>Radiation Protection and Shielding</i>)</li> <li>○ NE 5742 (<i>Nuclear Radiations and Their Measurements</i>)</li> <li>○ NE 6536 (<i>Nuclear Reactor Systems and Analysis</i>)</li> <li>○ NE 6708 (<i>Reactor Theory</i>)</li> <li>○ NE 6725 (<i>Nuclear Reactor Dynamics</i>)</li> <li>○ NE 6726 (<i>Reactor Dynamics Laboratory</i>)</li> <li>○ NE 6766 (<i>Nuclear Engineering Design</i>)</li> <li>○ NE 7865 (<i>Neutron Slowing Down and Thermalization</i>)</li> </ul> </li> <li>• Two additional nuclear engineering courses 5000-level or above are required</li> <li>• Two additional Math courses or one Math and one Stats course 5000-level or above are required</li> <li>• NE 8999 (<i>Nuclear Engineering Research for Dissertation</i>)</li> <li>• NE 6881 (<i>Nuclear Engineering Seminar</i>) every semester until Candidacy</li> <li>• First author journal submission</li> </ul>

**Mathematics Requirement.** Courses taken to fulfill the mathematics requirement *cannot* be used to satisfy the other letter graded graduate coursework requirements. A listing of suggested Math, Stats, or Math-equivalent courses can be found in Appendix II of this handbook.

**Journal submission.** Students who started their PhD program Autumn 2018 and beyond must have one submitted, submission-ready, or accepted peer-reviewed first author journal publication by the time he or she submits the Final Defense Pre-Approval.

## 5.2 MAE QUALIFYING EXAMINATION

The objective of the MAE Qualifying Examination (QE) is to determine whether the student is qualified to enter or continue in the Doctoral Program. The examination requires a comprehensive and in-depth understanding of undergraduate-level engineering principles and their application. The QE is given twice a year and they are administered by the faculty in the department. The committee for each subject is known as the QE Subject Committee and those members as designated by the MAE GSC.

Examiners in each subject area evaluate the performance of all students in that subject and grade their performance as satisfactory or unsatisfactory. Admission to, or continuation in, the PhD program is decided according to the following criteria:

1. A student must receive satisfactory grades in three subject areas to continue in or be admitted to the PhD Program.
2. A student who receives three unsatisfactory grades on their first attempt will be denied admission to, or further registration in, the PhD program.
3. If a student receives an unsatisfactory grade on two or fewer subject exams, at the next offering they will be required to retake the same number of QE subject exams for which they received an unsatisfactory grade. Students have the option to retake the same subject exams that they failed or they can elect to take subject exams in different areas. Students can retake the QE for any failed subject exams after their initial QE deadline if they take the QE at the latest possible date for which they are eligible.
4. No student may attempt the QE more than two times. Any student who does not satisfactorily complete three subject exams within two QE attempts will be denied admittance to, or further registration in, the PhD program.

**Registration.** Students in AAE or ME are required to take the QE in three subject areas. Each exam is a written three-hour exam. Students who started their PhD program before Autumn 2018 can select any three of the subjects listed below. Students who start their PhD program Autumn 2018 and beyond will be required to take the Math QE<sup>2</sup> and they will be required to take one QE chosen by their faculty advisor and one QE that is the student's choice.

Students must have a minimum 3.0 GPA and a faculty advisor with P-status in MAE on record in order to attempt the QE's. Any student who does not have a minimum 3.0 GPA and/or a faculty advisor with P-status on record will not be allowed to attempt the QE's. If a student does not satisfy the minimum GPA requirement within their required time frame to take the QE's, then the QE's will be postponed for up to one academic year while the student focuses on improving their GPA. Once the minimum GPA requirement has been met the student will be required to take the QE's at the next available offering. If a student does not meet the minimum GPA requirement within that one year period, they will be denied further registration in the PhD program.

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<sup>2</sup> Students who receive an 'A' or 'A-' in ME 8518/AAE 8802 are exempted from the Math QE requirement. Students exempted from the Math QE will only need to take and pass two QE subjects.

The timeline for QE registration is as follows:

- Students who are pursuing the BS-PhD path must take the QE by the fourth exam offering after enrolling in the PhD program.
- Students who pursuing the MS-PhD path must take the QE by the second exam offering after enrolling in the PhD program.
- Students who switch from an MS path to the BS-PhD path are required to take the QE as if they entered directly as a PhD student. That means they will have to take it by the fourth offering available based upon when they started at Ohio State or at the next available offering if they switch after their second year in the program.

If a student fails to register for and take the QE within the required time frame it will count as a failure of the QE and the student will forfeit one attempt of all three individual subject exams. The student must take and pass all three individual subject exams at the next offering or the student will be dismissed from the PhD program.

The available QE subject areas for students in the AAE and ME graduate programs are as follows:

- **AE Structures:** The examination will cover three main topics in aero structures: structural mechanics, structural dynamics, and energy methods.
- **Design:** The examination covers fundamentals of mechanical design; failure modes; stress analysis and failure prevention principles; design of mechanical elements.
- **Dynamics:** (registrants may only select one of the following)
  - **AE Dynamics, Systems, Control and Estimation:** Fundamentals of dynamic systems, translational and rotational motion, aircraft 6DOF dynamics, basic modern control theory, frequency methods, optimal control theory and basic estimation theory.
  - **ME Dynamics and Kinematics:** Dynamics of particles and rigid bodies; motion and force analysis of mechanisms.
- **Fluids** (registrants may only select one of the following)
  - **AE fluids:** Viscous flow (Navier-Stokes, boundary layers), 1-D compressible flow, potential flow
  - **ME fluids:** Integral balances; inviscid flows; viscous flows; turbulent flows; one-dimensional compressible flows.
- **Heat transfer:** Heat conduction; convection; radiation; multimode heat transfer.
- **Math:** Differential equations, linear algebra and a rudimentary understanding of applied probability
- **Measurements and controls:** Performance characteristics of motion, force, pressure, flow, and temperature transducers; data analysis; performance specifications for control systems; stability and error analysis techniques; controller concepts.
- **Mechanics of materials:** Static equilibrium analysis of simple structures and machines; stress-strain analysis of structural components under different load conditions; energy methods.

- **System dynamics and vibrations:** Dynamic response of mechanical, fluid, thermal, and electrical elements; mechanical vibrations; frequency response and transfer functions; analytical methods for linear systems.
- **Thermodynamics:** Conservation and balance principles; properties and property relations; nonreactive ideal-gas mixtures; combustion, thermochemistry, and chemical equilibrium.

**Results.** The QE Subject Committee reports each student's performance to the GSC Chair, who will communicate the results to the student and to the advisor. The decision on a student's qualifications to be admitted to, or continue in, the PhD Program is solely the responsibility of the GSC, which may take other factors into consideration.

If a student does not satisfactorily complete any QE subject exams on their first attempt or they do not satisfactorily complete three subject exams within two QE attempts, they will be denied admittance to, or further registration in, the PhD program.

**Oral QE Process.** The faculty advisor of any student who does not satisfactorily complete any QE subject exams on their first attempt or who does not satisfactorily complete three subject exams within two QE attempts may submit a petition to the GSC requesting that the student not be dismissed from the program. The petition must be submitted within 14 days of the results distribution. The GSC may deal with the petition by requiring the student, on whose behalf the petition was submitted, to undergo an oral examination (closed books, closed notes) on all subjects that were not passed satisfactorily during the most recent QE attempt. The following process is recommended:

- The Chair of the written subject exam in the area(s) the student failed shall request the examiners in those areas to serve on the oral exam committee. If any faculty members decline to serve on the oral exam committee, then the Chair of that area may ask other faculty members to replace him or her in the oral exam. The petitioning faculty member, advisors, or collaborators/likely committee members on the student's thesis must not participate in the oral exam in order to avoid a conflict of interest.
- The oral exam shall be held within one month after submission of the QE petition. The MAE Graduate Advising Office and Chair of the QE area(s) are responsible for scheduling and convening the oral exam committee. In case of a conflict of interest, the GSC Chair will replace the Chair of the QE subject exam(s) in this role.
- The oral exam may last up to, but not more than 1 hour, and will cover undergraduate material with a graduate understanding, consistent with the expectations on the written subject exam. The questions on the written QE may serve as a launch point for the oral exam.
- The oral exam committee shall consist of three voting faculty members, and a fourth non-voting faculty member from the GSC who, by authority of the GSC, shall make sure that the oral examination is conducted in a fair and appropriate manner.
- The oral examination committee members are not to discuss the student's performance on the oral exam during its administration or after its conclusion. They are to evaluate the student anonymously with a 0 (Unsatisfactory), or 2 (Satisfactory), on a ballot to be submitted immediately after the exam in respective envelopes delivered by the oral exam GSC Representative to the Graduate Program staff.
- Students must score 4/6 in order to pass the oral exam.

- The GSC Chair will notify the petitioner and student by email of the results of the oral exam. That notification will occur within 1 business day of the oral exam.
- Students undergoing the oral exam must pass every subject in which they are being examined, in order to remain in the program. In the event that they fail any or all of the oral exams, they are dismissed from the program. No further petitions on behalf of these students will be considered by the GSC.

### 5.3 NE QUALIFYING EXAMINATION

The NE Qualifying Examination (QE) covers the essential principles of nuclear engineering. The QE is offered once a year in the autumn semester and is administered by the faculty in the NE Graduate Program.

Examiners in each subject area evaluate the performance of all students in that subject and grade their performance as satisfactory or unsatisfactory. Admission to, or continuation in, the PhD program is decided according to the following criteria:

1. A student must receive satisfactory grades in all four subject areas to continue in or be admitted to the PhD Program.
2. A student with two or fewer sections with unsatisfactory grades must, at the next offering, retake only those parts of the examination on which an unsatisfactory grade was received.
3. A student with three or more sections with unsatisfactory grades must retake the entire examination at the next offering.
4. No student may attempt the QE more than two times. Any student who does not satisfactorily complete all four subject exams within two QE attempts will be denied admittance to, or further registration in, the PhD program.

The NE QE will be waived if the following criteria are met:

1. Completion of the core NE coursework with a minimum 3.0 GPA (B) average in that coursework, and
2. a minimum 3.90 GPA in 18 hours of letter-graded graduate level coursework.

Qualified PhD students, their faculty advisor, the NE program chair and assistant to the NE program will all be notified of all students exempted from the NE QE's by June 15 in order for the faculty and eligible students to properly prepare for the QE as needed.

**Registration.** PhD Students must take the NE QE's within the first two times it is offered to new exam takers. Students in NE are required to take the written exams in four subjects: three required topics and one specialty topic.

The available QE subject areas for students in the NE graduate program are as follows:

#### **Required Topics**

- **Reactor Physics and Engineering**
  - Covers material in NE 4505, NE 5708, NE 5725 and NE 5726
- **Radiation Physics (Radiation Protection/Health Physics), and Interaction with Matter (Detection, Instrumentation, Shielding)**

- Covers material in NE 5606, NE 5742 and NE 5766
- **Thermodynamics, Fluid Flow and Heat Transfer**
  - Covers material in ME 4501 NE 7536 and NE 6766

### Specialty Topics

- **Advanced Reactor Physics, Kinetics and Dynamics**
  - Covers material in NE 5708, NE 5725 and NE 5726
- **Fuel Cycle and Waste Management**
  - Covers material in NE 5766
- **Health Physics, Radiation Protection and Shielding**
  - Covers material in NE 5606 and NE 5742
- **Advanced Thermal Hydraulics**
  - Covers material in NE 6536, NE 6537, ME 6505 and ME 6510
- **Advanced Reactor Instrumentation and Control**
  - Covers material in NE 6725, NE 6726, NE 5742 and ME 3870
- **Advanced Topics in Safety and Risk Assessment**
  - Covers material in NE 5610, NE 5716 and NE 5717

**Results.** The NE QE Committee reports each student's performance to the GSC Chair, who will communicate the results to the student and to the advisor. The decision on a student's qualifications to be admitted to, or continue in, the PhD Program is solely the responsibility of the NE faculty committee, which may take other factors into consideration. Students who do not pass all four exams on their first attempt have the choice to retake the exams at one of two dates. Available dates to retake any required NE QE subject exams based upon the criteria outlined above will be provided at the time results are made available to the student and advisor.

## 5.3 CANDIDACY EXAMINATION

The Candidacy Examination (CE) is a single examination consisting of a written portion and an oral portion. The objective of this examination is to test the student's knowledge of the field and related areas of study, capacity to undertake independent research, and ability to think and express ideas clearly. Students are expected to graduate within five years of passing the Candidacy Exam.

**Candidacy Eligibility.** The CE must be taken within two years of passing the QE. Both the written and oral examinations, must be completed within a 60-day period and the student must be enrolled in at least 3 hours in any semester where a portion of the CE is being attempted. In addition, no student is permitted to take the CE more than twice. Students who do not take the CE within the timeframe above will be cited for a lack of reasonable progress for their intended degree and prohibited from further enrollment in their degree program.

If a student fails the CE, the student must retake the CE within one calendar year of the date the CE was initially taken. Failure to take the CE within that allotted time frame will result in the student being dismissed from the program.

Per Graduate School rules, if a student fails to submit the final copy of the dissertation to the Graduate School within five years of being admitted to candidacy, his or her candidacy is cancelled. At least 30 days before the cancellation of his or her candidacy, the student may petition the Graduate School to obtain, at most, a one semester extension of the candidacy period. The student must initiate a *Committee and Examination Petition* (available at <https://gradforms.osu.edu>) and he or she must provide a detailed plan to the MAE Graduate Advising Office for completing their degree in the following semester.

In the event a student's candidacy is cancelled, with the approval of the advisor and the GSC, the student may take a supplemental CE. The student is required to take the supplemental CE,

including an updated written component and a new oral component, by the end of the semester immediately following the cancellation of his or her candidacy. Failure to take the supplemental CE within that allotted time frame will result in the student being dismissed from the program and no additional extensions will be granted.

If the student passes the supplemental CE, the student is readmitted to candidacy and must then complete a dissertation within two years. If the student fails to complete his or her dissertation by the end of this two-year period, he or she will be dismissed from the program and no additional extensions will be granted.

**Candidacy Examination Committee.** In consultation with their advisor, all students pursuing a PhD degree in the MAE department are required to select a CE Committee which must consist of their advisor and three or more graduate faculty members. At least half of the members on the CE Committee should hold Doctoral advising status in the Department of Mechanical and Aerospace Engineering. One of the committee members must have MAE as their primary tenure-initiating unit (TIU). For second-time examinees, the Candidacy Examination Committee also includes a Graduate Faculty Representative (GFR) of the Graduate School. All members of the Candidacy Examination Committee, including the GFR when applicable, are voting members.

Additional committee members may be added to a CE Committee at the discretion of the GSC Chair (Section 7.3, *Graduate School Handbook*). To add an external (non-OSU faculty) member to the CE Committee, the student must initiate a *Committee and Examination Petition* (available at <https://gradforms.osu.edu>) at least four weeks before their planned Oral CE defense date. The request to add an external member to the CE Committee is subject to review by the student's faculty advisor and the GSC Chair. If approved, the petition is reviewed by the Graduate School for a final decision and the student will be notified of the result.

Students can change CE Committee members at any time prior to the submission of the *Application for Candidacy Examination* without penalty via the *Graduate Student Milestone Notification* form (<https://go.osu.edu/mae-gsmn>). To make any changes to the membership of the CE Committee after the *Application for Candidacy Examination* is submitted, the student must initiate a *Committee and Examination Petition* (available at <https://gradforms.osu.edu>). The request is subject to review by the student's faculty advisor and the GSC Chair. If approved, the petition is reviewed by the Graduate School for a final decision and the student will be notified of the result.

**Scheduling the Candidacy Examination.** Before a student will be permitted to schedule and take the CE the faculty who will serve as the CE Committee must unanimously approve of the student scheduling the exam by approving a pre-candidacy dissertation prospectus from the student. The committee is free to specify any reasonable length of dissertation proposal it feels appropriate. However, if the proposal is longer than the 15 pages, a short document effectively summarizing the full proposal is expected. The pre-candidacy dissertation proposal must be submitted to all members of the CE Committee for evaluation. The proposal should be concise and precise and should include the following:

1. Title and abstract
2. Significance of the problem
3. Scope and objectives of the research
4. Literature review
5. Methodology
6. Expected results and conclusions

## 7. Expected contributions to the state of art or the literature

Once the pre-candidacy dissertation proposal has been approved, the student must submit the *Application for Candidacy Examination* (available at <https://gradforms.osu.edu>) and the *Graduate Student Milestone Notification* form (<https://go.osu.edu/mae-gsmn>) reporting the CE. Both forms must be submitted at least three weeks before the students planned oral CE defense. The *Application for Candidacy Examination* must be approved by the student's faculty advisor and the MAE Graduate Advising Office no later than two weeks before the scheduled date of the student's defense and must include the names of the CE Committee members, the dates the written portion was submitted for review and approved, and the date, time and location of the oral candidacy defense. Any forms that are not approved by that two week deadline will not be considered by the Graduate School and the student will need to resubmit the form such that they can satisfy the Graduate School's mandatory deadline for such requests.

**Written Portion of the Candidacy Examination.** The written portion of the CE is administered and evaluated by the student's CE Committee. The student's pre-candidacy dissertation prospectus will serve as the written portion of the CE once it has unanimously been approved by the CE committee.

**Oral Portion of the Candidacy Exam.** Like the written portion of the CE, the oral portion of the CE is also administered and evaluated by the student's CE Committee. The oral portion of the examination lasts approximately two hours and is normally held within one month of the written examination. The candidate should expect questions that probe for a comprehensive knowledge of the candidate's dissertation proposal, research area, and graduate coursework. The student shall make no formal or informal presentation during the two-hour oral examination period. Any use of prepared materials must be limited and only in response to a specific question. Oral presentation of any proposal or other prepared materials must be made prior to, or after, the oral examination. Questioning of the student should occupy the entire period of the examination. All committee members are expected to participate fully in the questioning during the course of the examination and in the discussion of and decision on the result of the Candidacy Examination (Section 7.5, *Graduate School Handbook*).

Attendance at the oral portion of the Candidacy Examination is limited to the student and members of the Candidacy Examination Committee. Except when teleconferencing is involved, all members of the Candidacy Examination Committee must be present during the entire oral examination. One committee member can videoconference into the examination without prior approval of the GSC or the Graduate School. If more than one person requests to videoconference into the presentation the student must initiate a *Committee and Examination Petition* (available at <https://gradforms.osu.edu>) explaining why they are requesting additional members of the committee to videoconference into the examination. For additional guidelines pertaining to videoconferencing, please review the information provided by the Graduate School (Appendix B.1, *Graduate School Handbook*).

**Result of the Candidacy Exam.** The decision about the outcome of the CE is reached in the absence of the student. After discussion, the satisfactory/unsatisfactory decision is reached by means of a vote. Each examiner indicates judgment by posting their decision on the *Report on Candidacy Examination* form that must be submitted to the Graduate School (Section 7.6, *Graduate School Handbook*). That form will be available to the faculty committee members at <https://gradforms.osu.edu>. External committee members will be sent a link via email to access the report form and report their decision.

In the event a student fails the CE on the first attempt or their candidacy is cancelled and a supplemental CE is required the student can submit an *Application for Candidacy* once a new pre-candidacy dissertation proposal is approved unanimously by their proposed CE Committee. The *Application for Candidacy* must still be submitted and approved by the student's advisor and the

GSC Chair at least two weeks before the scheduled oral defense per Graduate School policy. Students will need to provide a copy of the written portion of the CE to the Graduate Faculty Representative as soon as one has been assigned.

## 5.4 CANDIDACY

The Graduate School outlines the parameters of candidacy. Students are bound to the policies outlined by the Graduate School and the program via the information that follows in order to maintain their candidacy status. Detailed information about candidacy can be found in section 7.7 of the *Graduate School Handbook*.

**Dissertation Committee.** The role of the dissertation committee is to advise the student in the final stages of their PhD. In consultation with their advisor and within one semester of successful completion of the CE in the MAE department students are required to identify their dissertation committee. The committee must consist of their advisor and two or more graduate faculty members, one of whom must be a tenure-track member of the MAE faculty. At least half of the members must hold doctoral advising status in the Department of Mechanical and Aerospace Engineering. External (non-OSU faculty) members can also serve on the committee but those members would be extra members in addition to the required number of faculty members (Section 7.9, *Graduate Studies Handbook*). The student must indicate which committee members, including any external members, who will be serving as the dissertation committee via the *Graduate Student Milestone Notification* form (<https://go.osu.edu/mae-gsmn>).

**Final Defense Pre-Approval.** Any student planning to graduate with their PhD must receive unanimous approval from their dissertation committee in order to schedule their final oral examination. A student must request Final Defense Pre-Approval via the *Graduate Student Milestone Notification* form (<https://go.osu.edu/mae-gsmn>) no later than one semester before they plan to graduate. Any student who began Autumn 2018 or after is also required to list one submitted, submission-ready, or accepted peer-reviewed journal publication for which they are first author.

Students must verify with their dissertation committee that they can move forward with scheduling the final defense via any combination of the following options:

1. Meeting of the entire committee to review progress relative to the prospectus and plans for completion (This meeting must last no more than 60 min total. It is not a “pre-defense”)
2. Provide committee members with copies of accepted journal papers for which the student is first author.
3. Private discussions with each committee member

The Final Defense Pre-Approval, including certification of an acceptable first author journal publication will be required before the MAE Graduate Advising Office will approve of an *Application to Graduate*. All members of the dissertation committee, including any external members, are required to review and authorize the student’s Final Defense Pre-Approval.

## 5.5 APPLYING TO GRADUATE

Students planning to graduate in a given semester must submit an *Application to Graduate* (available at <https://gradforms.osu.edu>) and a *Graduation Checkout* (via <https://go.osu.edu/mae-gsmn>) by no later than the first Friday of the semester in which they intend to graduate. PhD students are only required to list their faculty advisor at the time they apply to graduate. The *Application to Graduate* is subject to approval by the student’s advisor, the MAE

Graduate Advising Office, and the Graduate School. All members of the dissertation committee will be required to review and authorize the student's Final Defense Pre-Approval before the student's *Application to Graduate* will be approved.

**Before Your Final Examination.** In addition to the *Application to Graduate*, PhD students are also required to submit the *Application for Final Exam* (available at <https://gradforms.osu.edu>) and report their final examination information (via <https://go.osu.edu/mae-gsmn>) during the semester they plan to complete their PhD. Students will be asked to identify their committee members at the time they submit the forms listed above. The members of the dissertation committee will serve as the committee members for the student's final examination.

Students who have external committee members serving on their dissertation committee are also required to submit a *Committee and Examination Petition* (available at <https://gradforms.osu.edu>) requesting the inclusion of any external committee members on the final examination. The request to add an external member is subject to review by the student's faculty advisor and the GSC Chair. If approved, the petition is reviewed by the Graduate School for a final decision and the student will be notified of the result.

To make any changes to the membership of the dissertation committee once the *Application for Final Exam* has been submitted to the Graduate School, the student must initiate a *Committee and Examination Petition* (available at <https://gradforms.osu.edu>) detailing any changes. The request is subject to review by the student's faculty advisor and the GSC Chair. If approved, the petition is reviewed by the Graduate School for a final decision and the student will be notified of the result.

**Final Examination Preparation Guidelines.** Below are some general guidelines to help students plan out the final weeks leading up to their final examination.

- Students should provide a completed draft copy of their dissertation to their advisor at least **6-7 weeks** before their defense.
- Students should provide a completed draft copy of their dissertation to their dissertation committee **4-5 weeks** before their defense.
- A physical, typed dissertation draft must be checked for proper formatting by the Graduate School at least two weeks before the defense.<sup>3</sup>
  - More information about the format check is available at <https://gradsch.osu.edu/completing-your-degree/dissertations-theses/document-preparation>.
- The *Application for Final Exam* form must be submitted by the student and approved by their committee no later than two weeks before the students scheduled final oral examination.
  - Students who will be holding their defense at the Center for Automotive Research (CAR) or the Aerospace Research Center (ARC) are required to have those forms submitted and approved by their committees no later than three weeks before the students scheduled final oral examination.
- Students must provide a completed draft copy of their dissertation to the Graduate School's Faculty Representative (GFR) as soon as one has been assigned.

**The Final Oral Examination.** The final oral examination is an oral examination that lasts approximately two hours. A presentation of the dissertation research by the student is allowable. At

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<sup>3</sup> The Graduate School will not approve of the *Application for Final Exam* if the formatting has not been checked.

least one hour of the two-hour examination period, however, must be allotted to discussion of the research and to questions of and answers by the student (Section 7.9, *Graduate School Handbook*).

Attendance during the examination period is limited to the student and members of the dissertation committee. Except when teleconferencing is involved, all members of the dissertation committee and the GFR must be present during the entire oral examination. One committee member can videoconference into the examination without prior approval of the GSC or the Graduate School. If more than one person requests to videoconference into the presentation the student must initiate a *Committee and Examination Petition* (available at <https://gradforms.osu.edu>) explaining why they are requesting additional members of the committee to videoconference into the examination. For additional guidelines pertaining to videoconferencing, please review the information provided by the Graduate School (Appendix B.1, *Graduate School Handbook*).

**Result of the Final Oral Examination.** The decision about the outcome of the final oral examination is reached in the absence of the student. After discussion, the satisfactory/unsatisfactory decision is reached by means of a vote. Each examiner indicates judgment by posting their decision on the *Report on Final Examination* form that must be submitted to the Graduate School. This form can be accessed by the advisor and other dissertation committee members as well as the GFR at <https://gradforms.osu.edu>. External committee members will be sent a link to access the report forms. The student is considered to have completed the final oral examination successfully only when the decision of the final oral examination committee is unanimously affirmative (Section 7.10, *Graduate School Handbook*).

**Submission of the Final Copy of the Dissertation.** Final approval of the student's dissertation cannot occur until the final oral examination has been completed satisfactorily. Students are expected to submit the final copy of their dissertation to the Graduate School in the same semester in which they have successfully completed their final oral examination. Each dissertation committee member indicates approval by posting their decision on the *Report on Final Document* form that must be submitted to the Graduate School by the published deadline for the semester or summer term of graduation (Section 7.11, *Graduate School Handbook*). This form can be accessed by the advisor and OSU committee members and GFR at <https://gradforms.osu.edu>. External committee members will be sent a link to access the report forms.

**Final Defense and Dissertation Submission Time Limits.** In exceptional circumstances students can seek a one semester extension to complete their dissertation. Students must have satisfactorily passed the final oral examination and they must submit a statement, signed by their advisor and dissertation committee indicating the reason the dissertation was not completed during the same semester and when the final dissertation is expected to be ready. Students will have to enroll as a full-time student any semester in which they are finishing their dissertation. Failure to submit a final copy of the dissertation within one semester of completing their final oral examination will result in the student being cited for a lack of reasonable progress (Section 2.3).

Any student who has not completed both the dissertation and final oral examination within four calendar years after the Candidacy Examination must submit documentation of the progress to date, the work remaining, and a schedule to the dissertation committee. This document must be approved by the dissertation committee and forwarded to the GSC for action.

If a student fails to successfully complete the final oral examination and submit the final copy of the dissertation document to the Graduate School within five years of being admitted to candidacy, they will have their candidacy cancelled per Graduate School rules. In such a case, with the approval of the advisor and the Graduate Studies Committee, the student may take a supplemental candidacy examination. If the student passes this supplemental candidacy examination, the student is readmitted to candidacy and must then complete a dissertation document within two years (Section 7.7, *Graduate School Handbook*). Students who do not complete the requirements above within the aforementioned timeframe will be dismissed from the program.

## SECTION 6 – SPECIALTY PROGRAMS

### 6.1 COMBINED DEGREE PROGRAM

The purpose of the combined program is to give exceptional Ohio State undergraduate students an opportunity to double-count up to two courses of their required undergraduate technical elective coursework toward the coursework requirements for a MS or PhD in AAE, ME or NE.

**Program Eligibility.** Students who have earned at least 90 cumulative semester hours and are currently enrolled in either the AAE or ME undergraduate program or other engineering related disciplines, and have a cumulative grade-point average of 3.50 or higher in all previous undergraduate coursework, may apply. Undergraduate students from related disciplines are encouraged to apply for admission. Admission in such cases will be reviewed on a case-by-case basis.

**Program Rules.** The rules for the combined degree program are as follows:

- Students can double-count up to two courses toward their undergraduate and graduate degrees.
- Students are required to register for and complete either AAE or ME 4999H (*Honors Research*)
- Courses that are to be double-counted must be taken at Ohio State after acceptance into the combined degree program.
- Only AAE/ME/NE or other program approved courses 5000-level and above can be used for graduate credit as long as they meet the course requirements for the graduate degree being pursued.
- Combined degree students who have not yet completed their Bachelor's degree may take additional graduate level courses that will count for graduate credit only. Students intending to take such graduate-level courses must register for those courses in their graduate career stack.
- Upon receiving their undergraduate degrees, students enrolled in the combined degree program must meet all of the degree requirements for the degree they are pursuing as detailed in the previous sections of this handbook.

**Additional Information.** Below is some additional information regarding the combined degree program:

1. Once admitted to the combined degree program, students are officially graduate students and as such are assessed graduate tuition.
2. Rank 4 students will continue to be eligible for undergraduate scholarships until they obtain their undergraduate degrees.
3. Per Graduate School rules, combined degree students are eligible for GRA positions (Section 8.1, *Graduate School Handbook*).

**AAE Combined Degree Student Seminar Policy.** AAE students participating in the combined degree program are required to complete one of the following seminar requirements, whichever comes first:

- Enrollment in AAE 8890 (*Aerospace Engineering Graduate Seminar*) for the minimum number of semesters as detailed in the requirements for the degree you are pursuing; or
- Enrollment in AAE 8890 (*Aerospace Engineering Graduate Seminar*) each semester until the graduate degree is completed

## 6.2 DUAL DEGREE PROGRAM

Graduate School rules permit a student to pursue graduate degrees from two different graduate programs concurrently. Students interested for the dual degree program must already be admitted to a graduate degree seeking program at Ohio State. Students seeking admission to a dual degree program can submit a request for the dual degree program at any time so long as they are currently enrolled in a degree seeking graduate program. Students interested in pursuing the dual degree program in MAE must satisfy the following criteria:

1. Students will need to satisfy all graduation requirements set forth by both programs to receive a graduate degree from each program.
2. Students who are already pursuing a graduate degree in a MAE graduate program are not permitted to pursue the dual degree option with a second MAE graduate program but they can pursue a dual degree program in other departments.<sup>4</sup>
3. A minimum of 50 percent of required coursework must be unique to each degree.
4. Research credits must be unique to the program in which the student is getting a degree. Students cannot use research credit as the coursework to be counted towards each degree.

The dual degree process and requirements, as outlined by the Graduate School, can be found in detail at <http://go.osu.edu/dual-degree>.

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<sup>4</sup> Special requests for MAE graduate students to pursue the dual degree program in a second MAE graduate program will be considered. MAE graduate students can contact the MAE Graduate Advising Office for more information.

## APPENDIX I: APPROVED MATH COURSES

Any courses listed below can count towards the math requirements in MAE.

<b>COURSE #</b>	<b>COURSE TITLE</b>
MATH 4512	Applied Partial Differential Equations (for engineers)
MATH 4551	Vector Analysis
MATH 4568	Linear Algebra for Engineering Graduate Students
MATH 4578	Discrete Mathematical Models
MATH 5101	Finite Linear Math
MATH 5102	Infin Linear Math
MATH 5251	Complex Var & App
MATH 5601	Computational PDEs
MATH 5602	Ess Numer Methods
MATH 5801	Gen Topol & Knots
MATH 6411	Ordin Differ Eqs 1
MATH 6451	Part Differ Eqs 1
MATH 6601	Num Meth Sc Comp 1 & 2
MATH 6602	Num Meth Sc Comp 1 & 2
STAT 6301	Probability for Statistical Inference
STAT 6302	Theory of Statistical Analysis
STAT 6801	Statistical Theory I
STAT 6802	Statistical Theory II
ME 6507	Intermediate Numerical Methods
ME 8518	Advanced Mathematical Methods in Mechanical Engineering
AAE 8802	Advanced Mathematical Methods in Engineering
ECE 6750	Linear System Theory
ECE 6754	Nonlinear Systems Theory

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