

Mechanical Engineering and Aeronautical and Astronautical Engineering Graduate Programs Handbook

2015-2016 Edition

Department of Mechanical and Aerospace Engineering

The Ohio State University

N350 Scott Laboratory

201 West 19th Ave.

Columbus, OH 43210-1142

(614) 247-6605

Fax (614) 292-5740

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Revisions/Updates – Summary and sections

GRADFORMS.OSU.EDU is the Graduate School online site to submit applications to graduate, candidacy exams and several registration forms which require Graduation School approval: dual degree, combined degree, late course petition, transfer of graduate credit and transfer of graduate program.

I. 7 TRANSFERRING GRADUATE CREDIT

I. 8 TRANSFER AND/OR APPLIED CREDIT HOURS POLICY

AAE COMBINED DEGREE STUDENT SEMINAR POLICY

Aeronautical and Astronautical Engineering students enrolled in the combined degree program are required to complete one of the following seminar requirements, whichever comes first:

- a minimum of 3 semesters of AAE 8890 (Aerospace Engineering Seminar) once students are enrolled in the MS program;
- a minimum of 4 semesters of AAE 8890 once students are enrolled in the PhD program;
- upon completion of the Undergraduate degree, combined degree students must complete AAE 8890 each semester enrolled as graduate students until the graduate degree is completed

In instances where there is a time conflict with the regularly scheduled section of AAE 8890, students should enroll in the section of ME 8888 (Mechanical Engineering Seminar) without a scheduled time and complete its requirements to receive seminar credit for that semester.

ME SEMINAR GTA EXEMPTION

Mechanical Engineering students who are Graduate Teaching Associates (GTA's) do not need to satisfy the ME 8888 requirement while they are serving as a GTA. In order to be exempted from ME 8888, students who are GTA's in departments other than Mechanical and Aerospace Engineering will need to provide a letter stating your appointment and the appointing unit to the MAE Graduate Advising Office by the first Friday of each semester.

- ME GTA's should not register for ME 8888.

PREFACE

This handbook lists the policies, rules, and procedures relevant to the Mechanical Engineering and Aeronautical and Astronautical Engineering Graduate Programs. The specific graduate degree programs covered in this document are the Master of Science Program, the Mechanical Engineering Doctoral Program, the Aeronautical and Astronautical Engineering Doctoral Program, and the Combined Degree Program, and the Dual Master's Degree Program.

The *Graduate School Handbook* should be consulted for details regarding university rules and regulations. The *Graduate School Handbook* can be located in its entirety on the Graduate School website:

<http://www.gradsch.ohio-state.edu/Depo/PDF/Handbook.pdf>

SECTION I – ADMISSION

I.1 GENERAL INFORMATION

The Mechanical Engineering (ME) and Aeronautical and Astronautical Engineering (AAE) Graduate Programs admit students for the Autumn and Spring semesters. Applicants must complete the online application (WWW.GRADAPPLY.OSU.EDU) and submit *all* required application materials by the 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.

I.2 APPLICATION DEADLINES

The deadlines for admission are as follows:

<p><i>Autumn</i> – November 30 (Deadline for Fellowship consideration) January 15 (Deadline for general admission, GRA, and GTA consideration)</p> <p><i>Spring</i> – October 1</p>

I.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 in the Graduate School Handbook (*see* Section II.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 the student earned a bachelor's degree or higher in an English-speaking country.***

5. Additional criteria published by the Graduate Studies Committee of the local program

I.4 PROGRAM SPECIFIC ADMISSION CRITERIA

In addition to the admission criteria set forth by the Graduate School, the ME and AAE Graduate Programs require the following items:

1. One set of official transcripts from all undergraduate and graduate institutions attended
2. A one to two page statement of purpose
3. A one to two page résumé
4. Three letters of recommendation

Note: It is strongly suggested that these letters be from Faculty members or individuals that have received a PhD

5. Official GRE scores are required of all applicants¹

*Note: GRE scores are **not required** for OSU students applying to the Combined Degree program unless they are interested in being eligible for the University Fellowship competition.*

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

I.5 TRANSCRIPTS FOR OHIO STATE STUDENTS

Students, who attended Ohio State for their entire undergraduate education and earned their undergraduate degree from Ohio State, are not required to obtain official transcripts. The Graduate Admissions Office and the Department of Mechanical and Aerospace Engineering will acquire the transcript directly from the University Registrar's online records. If a student transferred to Ohio State or has taken any classes for undergraduate or graduate credit from a different university, a transcript from the other University(s) must be received directly by Ohio State's Graduate Admissions Office and the Department of Mechanical and Aerospace Engineering prior to being considered for admission.

I.6 TRANSFERRING INTO ME OR AAE

Students may transfer from another graduate program at Ohio State to the ME or AAE graduate program by completing the **Request for Transfer of Graduate Program** form found on **GRADFORMS.OSU.EDU**.

¹ Official GRE scores must be directly from Educational Testing Services (ETS).

This form requires the approval of the advisor and the Graduate Studies Committee in the ME or AAE program and the acknowledgment of the Graduate Studies Committee in the student's current program. The Graduate School will verify the student-provided information pertaining to the student's academic performance to the Graduate Studies Committee of the ME or AAE program. The Graduate Studies Committee also requires that students who wish to transfer into the ME or AAE program submit the following:

1. A personal statement indicating why the student is requesting to transfer to the program
2. Three letters of recommendation are strongly encouraged. It is suggested that at least two of the letters be from Faculty.
3. Request to have a copy of their current academic file from their current program sent to the ME or AAE Graduate Program.

Please note that Graduate Program Transfer requests must be submitted before the first week of the semester for the requested starting semester. Otherwise, the transfer will be effective for the next semester.

If the ME or AAE Graduate Studies Committee approves the transfer, it will specify the admission classification and the courses already completed that will count toward the student's graduate degree program. The ME or AAE Graduate Studies Committee 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. Doctoral Candidacy status does not generally transfer to a new graduate program.

I. 7 TRANSFERRING GRADUATE CREDIT

An unlimited number of graduate credit hours may be transferred from another university. However, at least 80% of credit hours required for a degree must be earned at The Ohio State University. The transfer of hours must be sought no later than the end of the first semester of enrollment in the program. ***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.***¹ (Section VII.2, *Graduate School Handbook*).

The number of graduate course credit hours that are transferred from another institution or through the Graduate Non-Degree program will be determined by the student's advisor and the ME or AAE Graduate Studies Committee.

When transferring credit from another university, the **Transfer of Graduate Credit** form (GRADFORMS.OSU.EDU) must be initiated by the student. The form will be reviewed by the advisor after which the Graduate Studies Committee Chair will review the transfer request. Once approved by the program, the request will be reviewed by the Graduate School for the final decision and if approved, the Graduate School will notify the student.

For students enrolled in the Graduate non-degree program, Graduate School rules apply.

I. 8 TRANSFER AND/OR APPLIED CREDIT HOURS POLICY

¹ Doctoral students who wish to transfer more than the 45 hours granted from transferring their Master's degree must have the courses approved by their Advisor and the Mechanical Engineering Graduate Studies committee Chair.

PhD students with coursework beyond their Master's from a previous university can petition the Graduate Studies Committee (GSC) requesting up to 3 courses or 9 credit hours be applied toward their required OSU PhD coursework. Any course to be considered for transfer credit must:

- be equivalent to 6000-level or higher graduate courses at OSU
- be taken within the last 3 years
- have a grade of "B" or higher

The Graduate Studies Committee will decide upon the petition based upon the following information provided by the student:

- 1.** A completed petition explaining the request
- 2.** A letter or email from the advisor supporting the request
- 3.** A copy of the transcript from the previous university
- 4.** Syllabi of the course(s)
- 5.** Identification of the equivalent OSU course(s), if any
- 6.** Submission of an OSU PhD Course Plan showing how the transferred course(s) would be applied to meet the OSU requirements.

The Graduate Studies Committee Petition can be found on the MAE website at:

[https://mae.osu.edu/graduate/forms-and-handbooks.](https://mae.osu.edu/graduate/forms-and-handbooks)

SECTION II – REGISTRATION AND ACADEMIC REQUIREMENTS

II.1 MINIMUM REGISTRATION REQUIREMENTS

The minimum registration requirements per semester, including the program seminar (if applicable) and research credits (ME 8998/8999 or AAE 8998/8999) are as follows:

1. Eight credit hours is required to be full-time for all students (US citizens, permanent residents, International students, or students holding a 50 percent Graduate Associate position)

Note: Four credit hours is considered full-time for students who hold a 50 percent Graduate Associate position during the Summer term

2. 12 credit hours is required to be full-time for all Fellowship students (i.e., university fellowships or other fellowships and scholarships) and eligible for a fee authorization

Note: Six credit hours is considered full-time for Fellowship students during the Summer term

3. Three credit hours is the minimum number of hours required in the expected semester of graduation

Note: GA's and Fellows must still register for the minimum number of hours required to maintain their appointment (*see 1 and 2 above*).

4. Three credit hours is required to be full-time for all PhD students admitted to candidacy (i.e. passed the Candidacy Exam)

Note: Students who start their doctoral studies Autumn Quarter 2008 or later are required to register for at least three credit hours during the autumn and spring semesters following admission to Candidacy. Any student who does not register for at least three credit hours will not be allowed to continue in the doctoral program until reinstated (Section VII.8, Graduate School Handbook).

II.2 MAXIMUM REGISTRATION ALLOWED

The maximum number of hours permitted by the Registrar's Office is 18 credit hours per semester or eight credit hours in summer session or four credit hours in May session.

II.3 SATISFACTORY ACADEMIC STANDING

To be in good academic standing in the Graduate School, a student must maintain a graduate cumulative point-hour ratio (CPHR) of 3.0 or higher in all graduate credit courses, and must maintain reasonable progress toward the degree requirements. A doctoral student who has had two unsatisfactory attempts at the Candidacy Examination or the Final Oral Examination or Professional Doctoral Examination is not considered in good academic standing and may be dismissed from the program per Graduate School rules (Section V.1, *Graduate School Handbook*).

In addition to the Graduate School's rules, if a student does not meet the following criteria the student is not considered in good academic standing within the Department of Mechanical and Aerospace Engineering:

1. A student who receives a “U” in ME 8998/8999 or AAE 8998/8999
2. A student who does not meet departmental conditions placed upon them
3. A student who has two unsuccessful attempts at passing the Qualifying Exams (*Mechanical Engineering students only*)

Students who are not in good academic standing will have their registration in future semesters blocked. In order to allow the student to register again, the advisor must contact the MAE Graduate Program Administrator with his or her approval for the student to register. Students who continue to have unsatisfactory academic progress may be subject to dismissal from the program.

II.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. 4000-level courses outside of the students program must be approved by the student’s advisor in order to count for graduate credit. No courses 3000-level or below and no 4000-level courses or below in the students 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.

II.5 CODE OF STUDENT CONDUCT

Students are expected to follow the Code of Student Conduct while they are pursuing a graduate degree in the Mechanical and Aerospace Engineering Department. The Code of Student Conduct covers the following topics:

- Academic misconduct
- Endangering health or safety
- Sexual misconduct
- Destruction of property
- Dangerous weapons or devices
- Dishonest conduct
- Theft/unauthorized use of property
- Failure to comply with university or civil authority
- Drugs
- Alcohol
- Unauthorized presence
- Disorderly or disruptive conduct
- Hazing
- Judicial system abuse
- Violation of university rules
- Riotous behavior
- Recording of images without knowledge

The Code of Student Conduct can be found in its entirety at http://studentlife.osu.edu/resource_csc.asp.

SECTION III – ADVISING

III.1 ADVISOR SELECTION

Selecting an advisor is probably one of the single most important decisions students will make during the course of their graduate career. It is important that students take time when choosing their advisor because he or she will be a key component in the student's success at the graduate level. It is important to be aware that master's and doctoral students do have different criteria when choosing an advisor and those criteria are as follows:

- **Masters students** - The advisor of a master's student must hold membership at the **Category M** level or higher in the student's graduate program. (Section XV.4, *Graduate School Handbook*)
- **DOCTORAL STUDENTS** - The advisor of a doctoral student must hold membership at the **Category P** level in the student's graduate program. (Section XV.4, *Graduate School Handbook*)

Students are strongly encouraged to choose an advisor, through mutual consent, as soon as possible. Students need to select an 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, students will be denied from further registration until an advisor has been selected. Once an advisor has been selected, a completed **Graduate Advisor Notification** form must be submitted on the MAE website at: <https://mae.osu.edu/graduate/forms-and-handbooks>.

Once the Graduate Advisor Notification form has been submitted, students who wish to change their advisor will be required to submit a new Graduate Advisor Notification form and identify the former advisor and new advisor.

III.2 GRADUATE PROGRAM COURSE PLAN

In consultation with their advisor, all students are required to complete and submit a MS or PhD Course Plan corresponding to the program and degree they are currently pursuing to the MAE Graduate Advising Office. Students must submit a completed tentative MS or PhD Course Plan by the end of their second semester of enrollment in the graduate program or further registration in the program will be blocked until a completed course plan is submitted. The Course Plan must be signed by the student's advisor before submitting it to the MAE Graduate Advising Office.

III.3 PETITIONS

Special requests will be processed when initiated by the student via submission of a **Petition to the Graduate Studies Committee**. The Graduate Studies Committee Petition form can be found on the MAE website at: The Graduate Studies Committee Petition can be found on the MAE website at: <https://mae.osu.edu/graduate/forms-and-handbooks>. The student's advisor will be contacted regarding her/his approval of the petition.

SECTION IV – MASTER OF SCIENCE DEGREE PROGRAM

IV.1 MASTER OF SCIENCE DEGREE REQUIREMENTS

A minimum of 30 credit hours, including course work and a satisfactory thesis or research paper, is required to obtain a Master of Science (MS) degree. The specific requirements for both the **thesis option** and **non-thesis option** are outlined in this section.

The entire work for the MS degree must be completed within a period of six calendar years.

AERONAUTICAL AND ASTRONAUTICAL ENGINEERING MS REQUIREMENTS – SEMESTERS

<i>THESIS OPTION</i>	<i>Non-THESIS OPTION</i>
<ol style="list-style-type: none"> 1. At least 3 hours of <u>letter graded</u> Mathematics courses 4000-level and above (except Math 4504), Statistics courses 5000-level and above, or other program approved Math Equivalency courses 2. At least 18 hours of <u>graduate level letter graded coursework</u> <ol style="list-style-type: none"> a) At least 12 hours of AAE or program equivalent b) At least 6 hours of courses 6000-level and above 3. At least 9 hours of AAE 6999 <u>or a combination of level approved coursework and AAE 6999 (at least 6 hours of AAE 6999/8998 is required).</u> 4. 3 hours of AAE Seminar 	<ol style="list-style-type: none"> 1. At least 3 hours of <u>letter graded</u> Mathematics courses 4000-level and above (except Math 4504), Statistics courses 5000-level and above, or other program approved Math Equivalency courses 2. At least 24 hours of <u>graduate level letter graded coursework</u> <ol style="list-style-type: none"> a) At least 12 hours of AAE or program equivalent courses 5000-level and above b) At least 12 hours of courses 6000-level and above 3. 3 hours of AAE 6999/8998 4. 3 hours of AAE Seminar

MECHANICAL ENGINEERING MS REQUIREMENTS – SEMESTERS

<i>THESIS OPTION</i>	<i>Non-THESIS OPTION</i>
<ol style="list-style-type: none"> 1. At least 3 hours of <u>letter graded</u> Mathematics courses 4000-level and above (except Math 4504), Statistics courses 5000-level and above, or other program approved Math Equivalency courses 2. At least 18 hours of <u>graduate level letter graded coursework</u> <ol style="list-style-type: none"> a) At least 9 hours of ME courses 5000-level and above b) At least 9 hours of courses 6000-level and above 3. At least 9 hours of ME 8998 <u>or a combination of level approved coursework and ME 8998 (at least 6 hours of ME 8998 is required).</u> 4. ME seminar every semester until graduation* 	<ol style="list-style-type: none"> 1. At least 3 hours of <u>letter graded</u> Mathematics courses 4000-level and above (except Math 4504), Statistics courses 5000-level and above, or other program approved Math Equivalency courses 2. At least 24 hours of <u>graduate level letter graded coursework</u> <ol style="list-style-type: none"> a) At least 12 hours of ME courses 5000-level and above b) At least 12 hours of courses 6000-level and above 3. 3 hours of ME 8998 4. ME seminar every semester until graduation*

*Mechanical Engineering students who are Graduate Teaching Associates (GTA's) do not need to satisfy the ME 8888 requirement while they are serving as a GTA. In order to be exempted from ME 8888, students who are GTA's in departments other than Mechanical and Aerospace Engineering will need to provide a letter stating your appointment and the appointing unit to the MAE Graduate Advising Office by the first Friday of each semester.

ME GTA's should not register for ME 8888.

IV.2 CHOOSING THE THESIS OR NON-THESIS OPTION

The MS thesis option is open to all entering MS students. Students who are currently supported by the Department of Mechanical and Aerospace Engineering via teaching, research, or administrative associate positions, University Fellowships, other fellowships, or scholarships that provide a fee authorization are expected to complete a thesis. The thesis option requires a thesis that represents a maximum of 9 credit hours of ME 8998 or AAE 6999/8998 of the 30 credit hours required, and the non-thesis option requires a research paper that represents 3 credit hours of ME 8998 or AAE 6999/8998 of the 30 credit hours required. Where there is a choice, the option selected should be reported to the MAE Graduate Advising Office by the end of the first semester of enrollment in the graduate program when submitting the **Graduate Advisor Notification** form at <https://mae.osu.edu/graduate/forms-and-handbooks> and submitting the MS Course Plan.

IV.3 MATHEMATICS REQUIREMENTS FOR MASTER'S DEGREE

Master's degree students may take a 4000-level and above Mathematics Department course **except *Math 4504 (History of Mathematics)*** to fulfill their mathematics requirement. Statistics Department 5000-level or above **letter-graded courses** or approved Math Equivalency letter-graded courses (i.e., not graded S/U), may be also be applied to meet the mathematics requirement. Courses taken to fulfill the mathematics requirement cannot be double counted to meet other requirements. A listing of those courses can be found in Appendix III of this handbook.

IV.4 6000-LEVEL COURSES

Unless used for mathematics credit 6000-level and above ME or AAE courses can be used to fulfill the program specific course requirements and 6000-level requirements for students seeking a Master's Degree. Students are, however, still required to meet the 30 credit hour minimum in order to earn a Master's Degree.

IV.5 AAE PROGRAM EQUIVALENT COURSES

A set of specified ME courses are able to be counted as AAE courses and can be used to meet AAE course requirements. A listing of those courses can be found in Appendix II of this handbook.

IV.6 MASTER'S EXAMINATION COMMITTEE

Students pursuing a Master of Science (MS) degree must have a MS Examination Committee that consists of at least two members of the graduate faculty in his or her graduate program, including the student's faculty advisor, with the faculty advisor serving as chair. At least half of the members on the MS Examination Committee should be from his or her graduate program.

IV.7 GRADUATION FOR MASTER'S STUDENTS

In order to graduate with a Master of Science (MS) degree, students must meet all requirements established by the program (as outlined in this handbook) and the University (see Section VI.6, *Graduate School Handbook*). In order to graduate with a MS in ME or AAE a student must meet the minimum requirements as stated in the Thesis Option Requirements section or the Non-Thesis Requirement section, depending on which program and option is pursued.

IV.8 APPLYING TO GRADUATE

An **Application to Graduate – Master’s form** - must be submitted no later than the **first Friday of the semester in which a student intends to graduate**. This timing allows for the MAE graduation checkout process, approval by the advisor, the Graduate Studies Committee Chair approval and meet the Graduate School deadline for applications to graduate.

In addition to the advisor, at least one additional MS Committee member must be listed on the Application to Graduate – Master’s form. Application to Graduate forms are available online at the Graduate School’s: GRADFORMS.OSU.EDU

IV.9 MASTER’S EXAMINATION

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

IV.10 ADDING EXTERNAL (NON-OSU FACULTY MEMBERS) TO A MASTER’S COMMITTEE

Additional faculty members may be added to a Master’s Committee at the discretion of the Graduate Studies Committee (Section VI.2, *Graduate School Handbook*). To add an external (non-OSU faculty) member to the Master’s Committee, the student must initiate a petition on GRADFORMS.OSU.EDU. Upon approval by the advisor and the Graduate Studies Committee Chair, the petition is reviewed by the Graduate School for a final decision and notification to the student.

IV.11 THESIS OPTION (MS EXAMINATION)

Below are details regarding the Master’s examination for students pursuing the thesis option.

1. The Master’s examination is oral and 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 may include a general presentation by the student open to visitors, followed by the actual thesis defense limited only to the MS Examination Committee and the student.
2. The committee’s decision on the Master’s examination is recorded on The Graduate School’s **Master’s Examination Report** form, and approval of the thesis is indicated on the **Thesis Approval Report** form. ***These Report forms are created after the student submits an Application to Graduate and can be accessed by the advisor and OSU committee members at GRADFORMS.OSU.EDU.***

a) External committee members will be sent a link to access the report form(s).

IV.12 NON-THESIS OPTION (MS EXAMINATION)

Below are details regarding the Master's examination for students pursuing the non-thesis option:

1. The examination will include a written portion and may include an oral portion. The format of the examination will be selected by the student's advisor, consistent with the requirements stated in this guide and in Section VI.2 of the *Graduate School Handbook*.
2. The written portion will be a minimum four-hour examination. It may either be a set of research problems, requiring the preparation of a formal paper, or a range of questions testing the candidate's broad knowledge of the course of study pursued.
3. 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.
4. The committee's decision on the Master's examination is recorded on The Graduate School's **Master's Examination Report** form, and approval of the thesis is indicated on the **Thesis Approval Report** form. ***These Report forms are created after the student submits an Application to Graduate and can be accessed by the advisor and OSU committee members at GRADFORMS.OSU.EDU.***

a) External committee members will be sent a link to access the report form(s).

IV.13 PURSUING A DOCTORAL DEGREE AFTER OBTAINING A MASTER'S DEGREE AT OHIO STATE

When submitting the MAE Graduation Checkout students indicate whether or not they will be pursuing a PhD. When the MAE Program Administrator approves applications to graduate that information is recorded and passed on to the Grad School.

IV.14 TRANSFERRING EXCESS MASTER'S DEGREE HOURS

Credits accrued beyond what is specified in the student's MS Graduate Program Course Plan may be used to meet the ME or AAE programs doctoral degree requirements, however only PhD-level appropriate courses are transferable. The Graduate School's **Transfer of Excess Master's Hours to the Doctoral Degree** form (<http://www.gradsch.ohio-state.edu/Depo/PDF/StatusBeyond.pdf>), along with student's transcript/advising report showing the grade(s) obtained in the course(s), must be submitted to the MAE Graduate Advising Office for approval by the Graduate Studies Committee.

IV.15 DUAL MASTER'S DEGREE PROGRAM

Graduate School rules permit a student to pursue Master's degrees from two different graduate programs concurrently. A minimum of 50 percent of required coursework must be unique to each degree and may not be used for dual credit. However, the Program's Graduate Studies Committee may establish a higher minimum (Section VI.7, *Graduate School Handbook*). The Dual Degree form can be found at: GRADFORMS.OSU.EDU.

MS Program Checklist

FIRST YEAR

- Select the *thesis* or *non-thesis option*.
- Choose an advisor and submit the **Graduate Advisor Notification** form
- Complete and submit a tentative **MS Course Plan**. (Course requirements vary depending on the program and whether the *thesis* or *non-thesis option* is selected.)

THE SEMESTER YOU INTEND TO GRADUATE

- Attend a MAE Graduation Workshop the first Friday of the semester (if you did not attend the Graduation Workshop in a previous semester)
- Submit an **Application to Graduate – Master’s** form - on **GRADFORMS.OSU.EDU** by the first Friday of the intended semester of graduation.
- Consult with your advisor and the committee member(s) to schedule a date and time for the Master’s Examination before the deadline set by the Graduate School.
- Your advisor and your MS Examination Committee will access the **Master’s Examination Report** and the **Thesis Exam Report** on **GRADFORMS.OSU.EDU**.
- You can check the status of the MS report forms on **GRADFORMS.OSU.EDU**.

SECTION V – AERONAUTICAL AND ASTRONAUTICAL ENGINEERING DOCTORAL DEGREE PROGRAM

V.1 DOCTORAL DEGREE REQUIREMENTS

The specific requirements for both the **BS-PhD Track** and **MS-PhD Track** are outlined in this section. Students on the BS-PhD track begin work toward a Doctoral degree directly after receiving a baccalaureate degree and acceptance as a PhD student whereas students on the MS-PhD track begin work toward a Doctoral degree after receiving a Master's degree.¹

A minimum of 80 graduate credit hours beyond the baccalaureate degree, including coursework and a dissertation, are required to obtain a doctoral degree in Aeronautical and Astronautical Engineering. 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.

BS-PHD COURSE REQUIREMENTS – SEMESTERS

1. **At least 6 hours of letter graded Mathematics or Statistics courses 5000-level and above or program approved Math Equivalency courses**
2. **At least 27 hours of graduate level letter graded coursework**
 - a) **At least 15 total hours of AAE or program equivalent courses of which at least 9 hours MUST be AAE or program equivalent courses 6000-level and above**
 - b) **At least 9 additional hours of courses 6000-level and above**
3. **At least 47 hours of AAE 8999 or a combination of level approved coursework and AAE 8999 (at least 30 hours of AAE 8999 is required)**
4. **4 hours of AAE seminar ***

MS-PHD COURSE REQUIREMENTS – SEMESTERS

1. **At least 3 hours of letter graded Mathematics or Statistics courses 5000-level and above or program approved Math Equivalency courses**
2. **At least 15 hours of graduate level letter graded coursework**
 - a) **At least 9 hours MUST be AAE or program equivalent courses 6000-level and above**
3. **At least 32 hours of AAE 8999 or a combination of level approved coursework and AAE 8999 (at least 21 hours of AAE 8999 is required)**
4. **2 hours of AAE seminar ***

*** AAE COMBINED DEGREE STUDENT SEMINAR POLICY**

Aeronautical and Astronautical Engineering students enrolled in the combined degree program are required to complete one of the following seminar requirements, whichever comes first:

¹ A student who starts in the BS-PhD program and later decides not to continue toward a PhD can apply completed course and thesis work toward a master's degree.

- a minimum of 3 semesters of AAE 8890 (Aerospace Engineering Seminar) once students are enrolled in the MS program;
- a minimum of 4 semesters of AAE 8890 once students are enrolled in the PhD program;
- upon completion of the Undergraduate degree, combined degree students must complete AAE 8890 each semester enrolled as graduate students until the graduate degree is completed

In instances where there is a time conflict with the regularly scheduled section of AAE 8890, students should enroll in the section of ME 8888 (Mechanical Engineering Seminar) without a scheduled time and complete the requirements to receive seminar credit for that semester.

V.2 MATHEMATICS REQUIREMENTS FOR DOCTORAL STUDENTS

Mathematics or Statistics Department 5000-level or above **letter-graded courses** or approved Math Equivalency letter-graded courses (i.e., not graded S/U), may be applied to meet the PhD-level mathematics requirement. Courses taken to fulfill the mathematics requirement cannot be double counted to meet other requirements. A listing of those courses can be found in Appendix III of this handbook.

Students in the BS-PhD program may count one Mathematics course (transition) or 3 hours (semester) at the 500-level (quarters) or 4000-level (semesters) courses with the exception of Math 504 (quarters) and Math 4504 (semesters)

V.3 AAE PROGRAM EQUIVALENT COURSES

A set of specified ME courses are able to be counted as AAE courses and can be used to meet AAE course requirements. A listing of those courses can be found in Appendix II of this handbook.

V.4 CANDIDACY EXAMINATION

The Candidacy Examination 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. It is generally taken after the student satisfies most of the course requirements. All examinations, written and oral, must be taken within a 60-day period. **It is required that the student take the Ph.D. Candidacy Examination within two years if entering the Ph.D. program with a M.S. degree or within three years if the student is entering the Ph.D. program with a B.S. degree.** No student is permitted to take the Candidacy Examination more than twice.

V.5 CANDIDACY EXAMINATION/DOCTORAL COMMITTEE

In consultation with their advisor, all students pursuing a Doctoral (PhD) degree must select their Candidacy Examination Committee, which will consist of their advisor and three or more graduate faculty members, and identify them on the Notification of Doctoral Candidacy Examination form when submitting the form on GRADFORMS.OSU.EDU. At least half of the members on the Candidacy Examination Committee should be from the Department of Mechanical and Aerospace Engineering.

The Candidacy Examination Committee for first-time examinees consists of the four person Candidacy Examination Committee. 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.

The Candidacy Examination Committee will also serve as a student's Doctoral committee. The Doctoral committee will serve as the student's Advisory Committee, Dissertation Committee, and Final Oral Examination Committee. The student's faculty advisor will serve as the Chair of the Doctoral committee.

V.6 CHANGING THE MEMBERS OF YOUR CANDIDACY EXAMINATION COMMITTEE

Only the student's advisor may request a change in the Candidacy Examination Committee membership by submitting a written request to the Graduate Studies Committee. The Graduate Studies Committee must approve changes in the Candidacy Examination Committee. If the Graduate Studies Committee approves the changes, the request will be forwarded to the Graduate School for the final decision.

V.7 ADDING EXTERNAL (NON-OSU FACULTY MEMBERS) TO YOUR DOCTORAL COMMITTEE

Additional faculty members may be added to a Doctoral Committee at the discretion of the Graduate Studies Committee (Section VII.9, *Graduate School Handbook*). To add an external (non-OSU faculty) member to the Doctoral Committee, the student must initiate a petition on GRADFORMS.OSU.EDU. Upon approval by the student's advisor and the AAE Graduate Studies Committee Chair, the petition is reviewed by the Graduate School for a final decision and notification to the student.

V.8 CERTIFICATION OF CANDIDACY ELIGIBILITY

Before the student can take the Candidacy Examination, the **Notification of Doctoral Candidacy Examination form** must be submitted on GRADFORMS.OSU.EDU. This form, including the names of the Doctoral Committee members, date, time and location of the Candidacy Examination, needs to be submitted in time to allow all the required approvals to be posted and the form is received by the Graduate School by the mandatory two-week notification deadline.

V.9 WRITTEN PORTION OF THE CANDIDACY EXAMINATION

The written portion of the examination consists of three separate examinations given by members of the advisory committee: An eight hour examination by the student's advisor, and two four hour examinations given by two other members of the student's advisory committee. The format of the examinations are determined by the faculty members administering them.

If, based on evaluating the written examination, the Candidacy Examination Committee members see no possibility for a satisfactory overall performance on the Candidacy Examination, the student may waive the right to take the oral examination. The Candidacy Examination Committee may not, however, deny a student the opportunity to take the oral examination.

If the student decides to waive the right to take the oral examination, a written statement requesting the waiver must be presented to the Candidacy Examination Committee. In such a case the Candidacy Examination Committee records an unsatisfactory on the Candidacy Examination Report form and returns it to the Graduate School with a copy of the student's waiver request.

V.10 ORAL PORTION OF THE CANDIDACY EXAMINATION

The oral portion of the examination lasts approximately two hours and is normally held within one month of the written examination. It must be scheduled at least two weeks in advance, and the Graduate School must be notified of its proposed time and place by the advisor, using the **Notification of Candidacy Examination form** on GRADFORMS.OSU.EDU. The advisor is responsible for transmitting to every

committee member the student's written portion of the general examination at least one week before the oral examination. A passing grade requires a unanimous vote of the committee.

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. **According to Graduate School rules, 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.

1. The written portion of the Candidacy Examination, which necessarily includes the dissertation proposal, must be graded by the dissertation committee. For second-time Candidacy Examinations, the dissertation proposal must be graded by the dissertation committee before being sent to the Graduate Faculty Representative.
2. The student will 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.
3. The candidate should expect questions that probe for a comprehensive knowledge of the candidate's dissertation proposal, research area, and graduate coursework. The student should discuss the scope of the questioning with each member of the committee before the examination.
4. Committee members can access the **Candidacy Examination Report after the exam** on **GRADFORMS.OSU.EDU** to indicate a Satisfactory or Unsatisfactory score.
 - a) **External committee members will be sent a link to access the report form.**

V.11 MAINTAINING CANDIDACY

Note: The following policy was approved in Autumn Quarter 2008 and is effective for all students who were admitted to the Graduate School Autumn Quarter 2008 and after. See Section VII.8 of the Graduate School Handbook.

All students who successfully complete the doctoral candidacy examination will be required to be enrolled in every semester of their candidacy (summer excluded) until graduation. Students must be enrolled for at least 3 credits per semester. While the Graduate School and the individual graduate programs will monitor the enrollment of all post-candidacy students, it ultimately will be the responsibility of each student to ensure that they are meeting the enrollment provisions of this policy.

Post-candidacy students who do not enroll in a required semester will be withdrawn from active candidacy status. A student whose candidacy status has been withdrawn will not be allowed to continue on in the doctoral program until reinstated. A hold will be placed on the student's university record preventing any further registration or access to university resources. A student wishing to be reinstated to the doctoral program and active candidacy status will need to petition the Graduate Studies Committee in their program. If approved, the Graduate Studies Chair of the program will send to the Graduate School a formal request to allow the student to resume studies and register. Non-enrollment does not interrupt a student's five year candidacy period.

Upon approval of a post-candidacy reinstatement, the student will be retroactively enrolled in every semester of missed enrollment for three credits of 8999 research hours under their advisor. The student will be responsible for paying the past tuition charges as well as the current university per semester late

registration penalty. All past due charges will need to be paid before the Graduate School will approve the student for any future enrollment.

Post-candidacy students who cannot continue in their doctoral program due to extenuating circumstances can request a leave of absence from their doctoral studies on a semesterly basis for up to a maximum overall leave period of one year. While there are many situations upon which a leave can be requested, such as the birth or adoption of a child or a serious medical condition, a leave will not be granted with the sole reason of financial hardship. The initial request for a leave should be submitted by the student to the Graduate Studies Committee in the student's home program. If the leave is approved at the program level, the Graduate Studies Chair will formally request the leave in writing to the Dean of the Graduate School. A request for a leave needs to be submitted before the actual leave period begins. Verification of circumstances should be included as part of the leave request. If a leave is granted, the student's candidacy period will be paused until the student returns to continuous enrollment status.

Any student who was admitted to the Graduate School before Autumn Quarter, 2008 is not bound by the continuous enrollment policy. However, a student who is not enrolled for at least 2 years will need to be reinstated to their graduate program to resume doctoral studies. As a condition of reinstatement a student will be required to follow the continuous enrollment guidelines as a post-candidacy student regardless of when they were admitted to the Graduate School.

V.12 GRADUATION FOR DOCTORAL STUDENTS

In order to graduate with a Doctoral (PhD) degree, students must meet all requirements established by the department (as outlined in this handbook) and the University (see Section VII.13, *Graduate School Handbook*). In order to graduate with a PhD in Aeronautical and Astronautical Engineering a student must meet the minimum requirements as stated in the BS-PhD Requirements section or the MS-PhD Requirements section, depending on which option is pursued.

V.13 APPLYING TO GRADUATE

An **Application to Graduate – Doctoral** form - must be submitted no later than the **first Friday of the semester in which a student intends to graduate**. This timing allows for the MAE graduation checkout process, approval by the advisor, the Graduate Studies Committee Chair approval and meet the Graduate School deadline for applications to graduate.

V.14 DISSERTATION DRAFT APPROVAL

The **Doctoral Draft Approval/Notice of Final Oral Examination** form on **GRADFORMS.OSU.EDU** needs to be submitted by the student and approved by all members of the committee and the Graduate Studies Committee Chair in time for the Graduate School to receive the approved form two weeks before the date of the Final Oral Examination.

- 1.** The typed dissertation draft must be checked by the Graduate School before that office will approve the Final Oral Examination.
- 2.** A complete, typed dissertation draft must be submitted to the Candidacy Examination Committee (which also serves as the Dissertation Committee) for approval.

V.15 FINAL ORAL EXAMINATION

The student initiates the scheduling of the examination by completing the **Notification of Final Oral Examination form on GRADFORMS.OSU.EDU**. The Final Oral Examination Committee, with the advisor as the Chair, also includes the following faculty members:

1. The student's Candidacy Examination Committee, which also serves as the Dissertation Committee
2. A representative appointed at its discretion by the Graduate Studies Committee
3. The Graduate School Faculty Representative (GFR)

The final oral examination lasts approximately two hours. A presentation of the dissertation research by the student is allowable. At 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. Local programs may develop additional local protocols and procedures (Section VII.10, *Graduate School Handbook*).

All members of the committee, including the Graduate School Representative, are voting members and will record their decisions on GRADFORMS.OSU.EDU. ***External committee members will be sent a link to access the report form(s).***

A student who has not completed his or her dissertation and final oral examination within four calendar years after the Candidacy Examination must submit to the Doctoral Committee documentation of the progress to date, the work remaining, and a schedule. This document must be approved by the Doctoral Committee and forwarded to the Graduate Studies Committee for action. If a student fails to submit the final copy of the dissertation document to the Graduate School within five years of being admitted to candidacy, his or her candidacy is 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 or D.M.A. document within two years (Section VII.8, *Graduate School Handbook*). Students who do not complete the requirements above within the aforementioned timeframe will be dismissed from the program.

AERO PHD PROGRAM CHECKLIST

FIRST YEAR

- Choose an advisor and submit the **Graduate Advisor Notification** form online at the MAE website at: <https://mae.osu.edu/graduate/forms-and-handbooks>
- Complete and submit a tentative **PhD Graduate Program Course Plan**. (Course requirements depend upon whether or not you have a Master's degree)

YEARS 2-3

- Take the Candidacy Examination. It is required that the student take the Ph.D. Candidacy Examination within two years if entering the PhD program with a MS degree or within three years if the student is entering the Ph.D. program with a B.S. degree.

THE SEMESTER YOU INTEND TO GRADUATE

- Attend a MAE Graduation Workshop the first Friday of the semester (if you did not attend the Graduation Workshop in a previous semester)
- Submit an **Application to Graduate – Doctoral** form on [GRADFORMS.OSU.EDU](https://mae.osu.edu/graduate/forms-and-handbooks) **by the first Friday of the intended semester of graduation.**

- Have a draft of the dissertation approved by your Dissertation Committee.

Have the typed dissertation draft format checked by the Graduate School (required before that office will approve the Final Oral Examination)

Submit the Notification of Final Oral Examination form on [GRADFORMS.OSU.EDU](https://mae.osu.edu/graduate/forms-and-handbooks) in time to allow all the required approvals to be posted and the form received by the Graduate School by the mandatory two-week notification deadline.

- Inform Aeronautical and Astronautical Engineering faculty members and graduate students one week in advance of your Final Oral Examination. Complete a **Defense Notification** form on the MAE website to advertise the defense: <https://mae.osu.edu/graduate/forms-and-handbooks>.

SECTION VI – MECHANICAL ENGINEERING DOCTORAL DEGREE PROGRAM

VI.1 DOCTORAL DEGREE REQUIREMENTS

The specific requirements for both the **BS-PhD Track** and **MS-PhD Track** are outlined in this section. Students on the BS-PhD track begin work toward a Doctoral degree directly after receiving a baccalaureate degree and acceptance as a PhD student whereas students on the MS-PhD track begin work toward a Doctoral degree after receiving a Master's degree.¹

A minimum of 80 graduate credit hours beyond the baccalaureate degree, including coursework and a dissertation, are required to obtain a doctoral degree in Mechanical Engineering. 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.

BS-PHD COURSE REQUIREMENTS – SEMESTERS

1. **At least 3 hours of letter graded Mathematics or Statistics courses 5000-level and above or program approved Math Equivalency courses**
2. **At least 30 hours of graduate level letter graded coursework**
 - a) At least 21 hours of courses 6000-level and above
 - b) At least 12 hours need to be ME or other program approved courses 6000-level and above
3. **At least 47 hours of ME 8999 or a combination of level approved coursework and ME 8999 (at least 30 hours of ME 8999 is required)**
4. **Seminar every semester until Candidacy****

MS-PHD COURSE REQUIREMENTS – SEMESTERS

1. **At least 3 hours of letter graded Mathematics or Statistics courses 5000-level and above or program approved Math Equivalency courses**
2. **At least 15 hours of graduate level letter graded coursework**
 - a) At least 9 hours MUST be ME courses 6000-level and above or other program approved courses
3. **At least 32 hours of ME 8999 or a combination of level approved coursework and ME 8999 (at least 21 hours of ME 8999 is required)**
4. **Seminar every semester until Candidacy****

**** ME SEMINAR GTA EXEMPTION**

Mechanical Engineering students who are Graduate Teaching Associates (GTA's) do not need to satisfy the ME 8888 requirement while they are serving as a GTA. In order to be exempted from ME 8888, students who are GTA's in departments other than Mechanical and Aerospace Engineering will need to provide a letter stating your appointment and the appointing unit to the MAE Graduate Advising Office by the first Friday of each semester.

¹ A student who starts in the BS-PhD program and later decides not to continue toward a PhD can apply completed course and thesis work toward a master's degree.

ME GTA's should not register for ME 8888.

VI.2 MATHEMATICS REQUIREMENTS FOR DOCTORAL STUDENTS

Mathematics or Statistics Department 5000-level or above ***letter-graded courses*** or approved Math Equivalency letter-graded courses (i.e., not graded S/U), may be applied to meet the PhD-level mathematics requirement. Courses taken to fulfill the mathematics requirement cannot be double counted to meet other requirements. A listing of those courses can be found in Appendix III of this handbook.

VI.3 QUALIFYING EXAMINATIONS

The objective of the Qualifying Examination 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 Qualifying Examination is given twice a year and is administered by faculty members in the Mechanical Engineering Graduate Program (the Qualifying Examination Committee) as designated by the Graduate Studies Committee.

Students are required to have an advisor on record prior to registering for the Qualifying Exams. Students who do not have an advisor on record will not be allowed to register for the Qualifying Exams. Students must also maintain satisfactory academic standing (see section II.3) in order to register for and take the Qualifying Exams.

Students who have a MS degree must take the Qualifying Exams by the second exam offering after enrolling in the PhD program. Students who are pursuing a PhD directly after completing their BS degree must take the Qualifying Exams by the fourth exam offering after enrolling in the PhD program. A student's scheduling window will be locked if the student fails to register for the QE within the required time frame.

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

Each student must take the Qualifying Examination in three elective areas out of the eight subjects listed. One of these areas must be in the student's major research area. Each exam is a written three-hour exam. More details about the Qualifying Examination subjects can be obtained by contacting the MAE Graduate Program Coordinator requesting access to the Carmen ME QE course.

QUALIFYING EXAM SUBJECTS

- **Design:** The examination covers fundamentals of mechanical design; failure modes; stress analysis and failure prevention principles; design of mechanical elements.
- **Dynamics and Kinematics:** Dynamics of particles and rigid bodies; motion and force analysis of mechanisms.
- **Fluid mechanics:** Integral balances; inviscid flows; viscous flows; turbulent flows; one-dimensional compressible flows.
- **Heat transfer:** Heat conduction; convection; radiation; multimode heat transfer.
- **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.

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

1. A student must receive satisfactory grades in each of the three elected areas to continue in or be admitted to the Doctoral Program.
2. A student who receives three unsatisfactory grades on the first attempt will be denied admission to, or further registration in, the Doctoral Program.
3. A student must, at the next offering, retake only those parts of the examination in which an unsatisfactory grade was received in order to continue in the program.
4. No student may take any part of the Qualifying Examination more than twice. ***A student who fails any part of the Qualifying Exam twice will be denied admittance to, or further registration in, the Doctoral Program.***

The Qualifying Examination Committee reports each student's performance to the Graduate Studies Committee 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 Doctoral Program is solely the responsibility of the Graduate Studies Committee, which may take other factors into consideration.

VI.4 CANDIDACY EXAMINATION

The Candidacy Examination 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. It must be taken ***within three years of passing the Qualifying Examination***. Students who do not take the Candidacy Exam within the timeframe above will be dismissed from the program. In addition, no student is permitted to take the Candidacy Examination more than twice.

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

Students are expected to graduate within five years of passing the Candidacy Exam. Per the 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. 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.

If a student's Candidacy is cancelled, with the approval of the advisor and the Graduate Studies Committee, the student may take a supplemental candidacy examination. The student is required to take the supplemental Candidacy Exam by the end of the semester immediately following the cancellation of, or the one semester extension of, his or her candidacy. Failure to take the supplemental Candidacy Exam within that allotted time frame will result in the student being dismissed from the program.

If the student passes this supplemental candidacy examination, 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.

VI.5 CANDIDACY EXAMINATION/DOCTORAL COMMITTEE

In consultation with their advisor, all students pursuing a Doctoral (PhD) degree must select their Candidacy Examination Committee which will consist of their advisor and three or more graduate faculty members and they must identify them on the Notification of Doctoral Candidacy Examination form prior to submitting the form to the Graduate School. At least half of the members on the Candidacy Examination Committee should be from the Department of Mechanical and Aerospace Engineering.

The Candidacy Examination Committee for first-time examinees consists of the four person Candidacy Examination Committee. 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.

The Candidacy Examination Committee will also serve as the Doctoral committee. The Doctoral committee will serve as the student's Advisory Committee, Dissertation Committee, and Final Oral Examination Committee. The student's faculty advisor will serve as the Chair of the Doctoral committee.

VI.6 CHANGING THE MEMBERS OF YOUR CANDIDACY EXAMINATION COMMITTEE

Only the student's advisor may request a change in the Candidacy Examination Committee membership by submitting a written request to the Graduate Studies Committee. The Graduate Studies Committee must approve changes in the Candidacy Examination Committee. If the Graduate Studies Committee approves the changes, the request will be forwarded to the Graduate School for the final decision.

VI.7 ADDING EXTERNAL (NON-OSU FACULTY MEMBERS) TO YOUR DOCTORAL COMMITTEE

Additional faculty members may be added to a Doctoral Committee at the discretion of the Graduate Studies Committee (Section VII.9, *Graduate School Handbook*). To add an external (non-OSU faculty) member to the Doctoral Committee, the student must initiate a petition on **GRADFORMS.OSU.EDU**. Upon approval by the student's advisor and the ME Graduate Studies Committee Chair, the petition is reviewed by the Graduate School for a final decision and notification to the student.

VI.8 CERTIFICATION OF CANDIDACY ELIGIBILITY

Before the student can take the Candidacy Examination, the **Notification of Doctoral Candidacy Examination form** must be submitted on **GRADFORMS.OSU.EDU**. This form, including the names of the Doctoral Committee members, date, time and location of the Candidacy Examination, needs to be submitted in time to allow all the required approvals to be posted and the form is received by the Graduate School by the mandatory two-week notification deadline.

VI.9 WRITTEN PORTION OF THE CANDIDACY EXAMINATION

The written portion of the Candidacy Examination is administered and evaluated by the student's Candidacy Examination Committee. It must include the preparation of a comprehensive dissertation proposal by the student. The dissertation 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

The Candidacy Examination Committee is free to specify any reasonable length of dissertation proposal it feels appropriate. However, if the proposal is longer than the NSF format (15 pages), a short document effectively summarizing the full proposal is expected. ***The dissertation proposal must be submitted to all members of the Candidacy Examination Committee for evaluation.***

The Candidacy Examination Committee will evaluate the written examination, including the dissertation proposal and the committee may ask the student to revise the proposal. An acceptable proposal is one that will result in a doctoral dissertation suitable for refereed journal publications.

If, based on evaluating the written examination, the Candidacy Examination Committee members see no possibility for a satisfactory overall performance on the Candidacy Examination, the student may waive the right to take the oral examination. The Candidacy Examination Committee may not, however, deny a student the opportunity to take the oral examination.

If the student decides to waive the right to take the oral examination, a written statement requesting the waiver must be presented to the Candidacy Examination Committee. In such a case the Candidacy Examination Committee records an unsatisfactory on the Candidacy Examination Report form and returns it to the Graduate School with a copy of the student's waiver request.

VI.10 ORAL PORTION OF THE CANDIDACY EXAMINATION

The oral portion of the examination lasts approximately two hours and is normally held within one month of the written examination. It must be scheduled at least two weeks in advance, and the Graduate School must be notified of its proposed time and place by the student, using the **Notification of Candidacy Examination form** on **GRADFORMS.OSU.EDU**. The advisor is responsible for transmitting to every committee member the student's written portion of the general examination at least one week before the oral examination. A passing grade requires a unanimous vote of the committee.

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. ***According to Graduate School rules, 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.

1. The written portion of the Candidacy Examination, which necessarily includes the dissertation proposal, must be graded by the dissertation committee. For second-time Candidacy Examinations, the dissertation proposal must be graded by the dissertation committee before being sent to the Graduate Faculty Representative.
2. The student will 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.
3. The candidate should expect questions that probe for a comprehensive knowledge of the candidate's dissertation proposal, research area, and graduate coursework. The student should discuss the scope of the questioning with each member of the committee before the examination.
4. Committee members can access the **Candidacy Examination Report after the exam** on **GRADFORMS.OSU.EDU** to indicate a Satisfactory or Unsatisfactory score.
 - a) ***External committee members will be sent a link to access the report form.***

VI.11 MAINTAINING CANDIDACY

Note: The following policy was approved in Autumn Quarter 2008 and is effective for all students who were admitted to the Graduate School Autumn Quarter 2008 and after. See Section VII.8 of the Graduate School Handbook.

All students who successfully complete the doctoral candidacy examination will be required to be enrolled in every semester of their candidacy (summer excluded) until graduation. Students must be enrolled for at least 3 credits per semester. While the Graduate School and the individual graduate programs will monitor the enrollment of all post-candidacy students, it ultimately will be the responsibility of each student to ensure that they are meeting the enrollment provisions of this policy.

Post-candidacy students who do not enroll in a required semester will be withdrawn from active candidacy status. A student whose candidacy status has been withdrawn will not be allowed to continue on in the doctoral program until reinstated. A hold will be placed on the student's university record preventing any further registration or access to university resources. A student wishing to be reinstated to the doctoral program and active candidacy status will need to petition the Graduate Studies Committee in their program. If approved, the Graduate Studies Chair of the program will send to the Graduate School a formal request to allow the student to resume studies and register. Non-enrollment does not interrupt a student's five year candidacy period.

Upon approval of a post-candidacy reinstatement, the student will be retroactively enrolled in every semester of missed enrollment for three credits of 8999 research hours under their advisor. The student will be responsible for paying the past tuition charges as well as the current university per semester late registration penalty. All past due charges will need to be paid before the Graduate School will approve the student for any future enrollment.

Post-candidacy students who cannot continue in their doctoral program due to extenuating circumstances can request a leave of absence from their doctoral studies on a semesterly basis for up to a maximum overall leave period of one year. While there are many situations upon which a leave can be requested, such as the birth or adoption of a child or a serious medical condition, a leave will not be granted with the sole reason of financial hardship. The initial request for a leave should be submitted by the student to the Graduate Studies Committee in the student's home program. If the leave is approved at the program level, the Graduate Studies Chair will formally request the leave in writing to the Dean of the Graduate School. A request for a leave needs to be submitted before the actual leave period begins. Verification of circumstances should be included as part of the leave request. If a leave is granted, the student's candidacy period will be paused until the student returns to continuous enrollment status.

Any student who was admitted to the Graduate School before Autumn Quarter, 2008 is not bound by the continuous enrollment policy. However, a student who is not enrolled for at least 2 years will need to be reinstated to their graduate program to resume doctoral studies. As a condition of reinstatement a student will be required to follow the continuous enrollment guidelines as a post-candidacy student regardless of when they were admitted to the Graduate School.

VI.12 GRADUATION FOR DOCTORAL STUDENTS

In order to graduate with a Doctoral (PhD) degree, students must meet all requirements established by the department (as outlined in this handbook) and the University (see Section VII.13, *Graduate School Handbook*). In order to graduate with a PhD in Mechanical Engineering a student must meet the minimum requirements as stated in the BS-PhD Requirements section or the MS-PhD Requirements section, depending on which option is pursued.

VI.13 APPLYING TO GRADUATE

An **Application to Graduate – Master's** form - must be submitted no later than the **first Friday of the semester in which a student intends to graduate**. This timing allows for the MAE graduation checkout process, approval by the advisor, the Graduate Studies Committee Chair approval and meet the Graduate School deadline for applications to graduate.

VI.14 DISSERTATION DRAFT APPROVAL

The **Doctoral Draft Approval/Notice of Final Oral Examination** form on **GRADFORMS.OSU.EDU** needs to be submitted by the student and approved by all members of the committee and the Graduate Studies

Committee Chair in time for the Graduate School to receive the approved form two weeks before the date of the Final Oral Examination form.

1. The typed dissertation draft must be checked by the Graduate School before that office will approve the Final Oral Examination.
2. A complete, typed dissertation draft must be submitted to the Dissertation Committee for approval.

VI.15 FINAL ORAL EXAMINATION

The student initiates the scheduling of the examination by completing the **Notification of Final Oral Examination form on GRADFORMS.OSU.EDU**. The Final Oral Examination Committee, with the advisor as the Chair, also includes the following faculty members:

1. The student's Candidacy Examination Committee, which also serves as the Dissertation Committee
2. A representative, appointed at its discretion, by the Graduate Studies Committee
3. The Graduate School Faculty Representative (GFR)

The final oral examination lasts approximately two hours. A presentation of the dissertation research by the student is allowable. At 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. Local programs may develop additional local protocols and procedures (Section VII.10, *Graduate School Handbook*).

All members of the committee, including the Graduate School Representative, are voting members. The student must submit the signed **Final Dissertation Approval** form and the **Final Oral Examination Report** to the Graduate School. ***Copies of the signed forms along with a copy of the cover sheet of the Dissertation must be submitted to the MAE Graduate Advising Office.***

A student who has not completed his or her dissertation and final oral examination within four calendar years after the Candidacy Examination must submit to the Doctoral Committee documentation of the progress to date, the work remaining, and a schedule. This document must be approved by the Doctoral Committee and forwarded to the Graduate Studies Committee for action. If a student fails to submit the final copy of the dissertation document to the Graduate School within five years of being admitted to candidacy, his or her candidacy is 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 or D.M.A. document within two years (Section VII.8, *Graduate School Handbook*). Students who do not complete the requirements above within the aforementioned timeframe will be dismissed from the program.

MECHANICAL PHD PROGRAM CHECKLIST

FIRST YEAR

- Choose an advisor and submit the **Graduate Advisor Notification** form found on the MAE website
- Complete and submit a tentative **PhD Graduate Program Course Plan**. (Course requirements depend upon whether or not you have a Master's degree)
- Students with a Master's degree need to sign up to take the Qualifying Examination's no later than the second time it is offered. Remember to sign up for three elective areas out of the eight areas listed earlier in this guide. One of the examination subjects must be in your major research area.

SECOND YEAR (IF APPLICABLE)

- Students with a Bachelor's degree who are pursuing a PhD directly need to sign up to take the Qualifying Examination's no later than the fourth time it is offered. Remember to sign up for three elective areas out of the eight areas listed earlier in this guide. One of the examination subjects must be in your major research area.

WITHIN THREE YEARS OF PASSING THE QUALIFYING EXAMS

- Take the Candidacy Examination. Students who do not take the Candidacy Exam within this timeframe will be dismissed from the program.

THE SEMESTER YOU INTEND TO GRADUATE

- Attend a MAE Graduation Workshop the first Friday of the semester (if you did not attend the Graduation Workshop in a previous semester)
- Submit an **Application to Graduate – Doctoral** form - on **GRADFORMS.OSU.EDU** **by the first Friday of the intended semester of graduation.**
 - Have a draft of the dissertation approved by your Dissertation Committee.
 - Have the typed dissertation draft format checked by the Graduate School (required before that office will approve the Final Oral Examination)
 - Submit the Notification of Final Oral Examination form on **GRADFORMS.OSU.EDU** in time to allow all the required approvals to be posted and the form received by the Graduate School by the mandatory two-week notification deadline.
- Inform Mechanical Engineering faculty members and graduate students one week in advance of your Final Oral Examination. Complete a **Defense Notification** form on the MAE website to advertise the defense: <https://mae.osu.edu/graduate/forms-and-handbooks>.

SECTION VII – THE COMBINED DEGREE PROGRAM

VII.1 THE COMBINED DEGREE PROGRAM

The purpose of the combined program is to give exceptional OSU undergraduate students an opportunity to double-count up to 12 credit hours depending on their program of study (see section VII.3) of their undergraduate technical elective courses toward a Master of Science (MS) degree or Doctoral (PhD) degree in Mechanical or Aeronautical and Astronautical Engineering, thus reducing the amount of time normally required to complete the graduate degree.

VII.2 PROGRAM ELIGIBILITY

Students who have earned at least **90 total credit hours** in the Department of Mechanical and Aerospace Engineering or other engineering related disciplines, and have a cumulative **grade-point average of 3.5 or higher** in all previous undergraduate coursework, may apply. Undergraduate students from related disciplines are encouraged to apply for admission and they will be handled on a case-by-case basis.

VII.3 PROGRAM RULES

Students can take classes that can be counted toward both their undergraduate and graduate degree.

- Students applying to the Aeronautical and Astronautical Engineering Graduate Program can double-count up to 6 hours toward their undergraduate and graduate degrees.
- Students applying to the Mechanical Engineering Graduate Program can double-count up to 12 hours toward their undergraduate and graduate degrees.

In order to receive graduate credit the courses must meet the following requirements:

1. Technical elective courses taken at Ohio State after acceptance into the combined degree program.
2. Only ME/AAE/NE courses 5000-level and above can be used as long as they meet the course requirements for the graduate degree being pursued.
3. Relevant graduate courses in other subjects, such as Mathematics (as allowed by the ME/AAE technical electives program) may be included; refer to the technical electives program for guidelines.

Students can also take graduate level courses for graduate credit only once admitted to the BS/MS program which can further reduce the time to a MS degree.

VII.4 APPLYING TO THE PROGRAM

1. Complete the application for Graduate School, available online at www.gradapply.osu.edu.
2. Submit a Combined BS/MS Degree Information Sheet (GRADFORMS.OSU.EDU)
3. Submit a Statement of Purpose
4. Submit a Resume

5. Submit **ANY** and **ALL** post-secondary transcripts for credit received at any institution **EXCEPT** Ohio State. Any coursework you have completed at Ohio State will be obtained internally.
6. Submit **THREE** letters of recommendation.
7. GRE Scores are **NOT REQUIRED** for students applying to the BS/MS program, however if you have **ANY** interest in possibly pursuing a PhD, students are strongly encouraged to take the GRE's as more funding opportunities become available if pursuing a PhD.

VII.5 ADVISING FOR COMBINED DEGREE STUDENTS

Once enrolled in the program, students are encouraged to work with individual faculty members on research projects and independent studies and these faculty members will serve as Research Advisors. Students need to select an advisor by the 10th week of their first semester of enrollment in the combined degree program. BS/MS students must submit the **Graduate Advisor Notification** form at: <https://mae.osu.edu/graduate/forms-and-handbooks>

VII.6 COMBINED DEGREE RESEARCH ABSTRACT

Students in the pursuing the Thesis Option or a PhD must submit a short abstract (less than 500 words) by the 10th week of their first semester in the program. You must submit a copy of your abstract to your advisor and have it signed by your advisor. Once it is signed by your advisor, submit that abstract to the MAE Graduate Advising Office. This abstract should address the following:

1. The background on the student's area of graduate research
2. The specific purpose/question/hypothesis associated with the student's research
3. The preliminary methods the students will employ during their graduate research
4. The impact of this research on the chosen field

VII.7 ADDITIONAL INFORMATION FOR COMBINED DEGREE STUDENTS

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. Upon receiving their undergraduate degrees, students enrolled in the combined degree program must meet all of the degree requirements for the degree being pursued as detailed in the previous sections of this handbook
4. Per Graduate School rules, combined degree students are eligible for GRA positions (Section VIII.1, *Graduate School Handbook*).
5. 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 stack.

VII.8 AAE COMBINED DEGREE STUDENT SEMINAR POLICY

Aeronautical and Astronautical Engineering students enrolled in the combined degree program are required to complete one of the following seminar requirements, whichever comes first:

- a minimum of 3 semesters of AAE 8890 (Aerospace Engineering Seminar) once students are enrolled in the MS program;
- a minimum of 4 semesters of AAE 8890 once students are enrolled in the PhD program;
- upon completion of the Undergraduate degree, combined degree students must complete AAE 8890 each semester enrolled as graduate students until the graduate degree is completed

In instances where there is a time conflict with the regularly scheduled section of AAE 8890, students should enroll in the section of ME 8888 (Mechanical Engineering Seminar) without a scheduled time and complete its requirements to receive seminar credit for that semester.

APPENDIX I: ME AND AAE GRADUATE COURSES

Aerospace	
COURSE NO.	COURSE TITLE
AAE 5610	Helicopter Aerodynamics
AAE 5612	Aircraft Performance and Flight Test Engineering
AAE 5615	Introduction to Computational Fluid Dynamics
AAE 5620	Stability and Control of Flight Vehicles
AAE 5621	Guidance, Navigation and Control of Aerospace Vehicles
AAE 5626	Orbital Mechanics for Engineers
AAE 5645	Introduction to Structure Dynamics and Aeroelasticity of Aerospace Vehicles
AAE 5751	Advanced Air-Breathing Propulsion
AAE 5752	Advanced Rocket Propulsion
AAE 5771	Viscous Fluid Flow: Laminar and Transitional
AAE 5775	Hypersonic Flows
AAE 6860	Experimental Fluid Dynamics
AAE 7720	Advanced Stability and Control of Flight Vehicles
AAE 7774	Aeroacoustics
AAE 7842	Advanced Structures for Flight Vehicles
AAE 7844	Optimal Design of Aerospace Structures
AAE 7862	Internal Flow in Turbomachinery
AAE 7875	Introduction to Turbulence
AAE 8820	Robust Multivariable Control with Applications
AAE 8851	Advanced Propulsion Problems
AAE 8866	Hydrodynamic Stability of Fluid Motions
AAE 8873	Computational Fluid Dynamics

Applied Mechanics	
<i>(Biomechanics, Elasticity, FEM, Materials, Stress/Strain, Tribology)</i>	
COURSE NO.	COURSE TITLE
ME 5068	Introduction to the Finite Element Method
ME 5139	Applied Finite Element Method
ME 5144	Engineering Fracture Mechanics
ME 5162	Introduction to Laminated Composite Materials
ME 5372	Design and Control of Mechatronic Systems
ME 5374	Smart Materials and Intelligent Systems
ME 6700	Intro to Musculoskeletal Biomechanics
ME 7040	Elasticity
ME 7100	Introduction to Continuum Mechanics
ME 7101	Constitutive Models in Continuum Mechanics
ME 7163	Advanced Strength of Materials and Elasticity Theory

ME 7230	Advanced Dynamics
ME 7751	Advanced Kinematics and Mechanisms
ME 7760	Form Synthesis, Assembly, and Applied Stress Analysis
ME 7765	Principles and Applications of Tribology
ME 7837	Nanotechnology and Biomimetics
ME 8043	Advanced Elasticity
ME 8100	Advanced Topics in Continuum Mechanics
ME 8702	Neuromuscular Biomechanics
AAE 5645	Introduction to Structure Dynamics and Aeroelasticity of Aerospace Vehicles
AAE 7842	Advanced Structures for Flight Vehicles

Automotive <i>(Automotive NVH, IC Engine Systems, Powertrain Dynamics and Control)</i>	
COURSE NO.	COURSE TITLE
ME 5234	Vehicle Dynamics
ME 5530	Internal Combustion Engines
ME 5531	Automotive Powertrain Laboratory
ME 7236	Powertrain Dynamics
ME 7260	Automotive Noise and Vibration Control I
ME 7262	Automotive Noise and Vibration Control II
ME 7384	Energy Modeling, Simulation, Optimization and Control of Advanced Vehicles
ME 7440	Internal Combustion Engine Modeling
AAE 5615	Introduction to Computational Fluid Dynamics
AAE 6860	Experimental Fluid Dynamics
AAE 8873	Computational Fluid Dynamics

Dynamic Systems and Controls <i>(Acoustics, Control, Dynamics, Measurements, Smart Materials, Vibration)</i>	
COURSE NO.	COURSE TITLE
ME 5234	Vehicle Dynamics
ME 5372	Design and Control of Mechatronic Systems
ME 5374	Smart Materials and Intelligent Systems
ME 5531	Automotive Powertrain Laboratory
ME 7230	Advanced Dynamics
ME 7236	Powertrain Dynamics
ME 7250	Vibration of Discrete Systems
ME 7260	Automotive Noise and Vibration Control I
ME 7262	Automotive Noise and Vibration Control II
ME 7290	Digital Control Engineering
ME 7370	Measurement Systems and Experimental Techniques
ME 7380	Lumped Parameter Modeling and System Analysis
ME 7752	Mechanics and Control of Robots
ME 8043	Advanced Elasticity

ME 8230	Nonlinear Dynamics
ME 8250	Vibration of Continuous Systems
ME 8260	Advanced Engineering Acoustics
ME 8320	Digital Signal and Random Data Analysis for Mechanical Systems
ME 8372	Fault Diagnosis in Dynamic Systems
AAE 5620	Stability and Control of Flight Vehicles
AAE 5621	Guidance, Navigation and Control of Aerospace Vehicles
AAE 5626	Orbital Mechanics for Engineers
AAE 5645	Introduction to Structure Dynamics and Aeroelasticity of Aerospace Vehicles
AAE 7720	Advanced Stability and Control of Flight Vehicles
AAE 8820	Robust Multivariable Control with Applications

Design and Manufacturing <i>(CAD/CAM, Design, Measurements, Reliability, Tool Engineering)</i>	
COURSE NO.	COURSE TITLE
ME 5068	Introduction to the Finite Element Method
ME 5665	Reliability Engineering I
ME 5666	Reliability Engineering II
ME 5680	Computer Aided Design and Manufacturing
ME 5682	Fundamentals of Product Design Engineering
ME 7163	Advanced Strength of Materials and Elasticity Theory
ME 7370	Measurement Systems and Experimental Techniques
ME 7751	Advanced Kinematics and Mechanisms
ME 7752	Mechanics and Control of Robots
ME 7760	Form Synthesis, Assembly, and Applied Stress Analysis
ME 7761	Optimum Design of Machines and Structures
ME 7765	Principles and Applications of Tribology
AAE 5615	Introduction to Computational Fluid Dynamics
AAE 7844	Optimal Design of Aerospace Structures

Energy, Fluid, and Thermal Systems <i>(Combustion, Fluid Mechanics, Gas Dynamics, Heat Transfer, Thermodynamics)</i>	
COURSE NO.	COURSE TITLE
ME 5427	Introduction to Turbomachinery
ME 5530	Internal Combustion Engines
ME 5531	Automotive Powertrain Laboratory
ME 5541	Heating, Ventilating, and Air Conditioning
ME 6501	Gas Dynamics
ME 6505	Intermediate Fluid Dynamics
ME 6507	Intermediate Numerical Methods
ME 6510	Intermediate Heat and Mass Transfer
ME 6515	Introduction to Micro and Nanofluidics

ME 6526	Combustion
ME 6537	Nuclear Reactor Thermal Hydraulics
ME 7440	Internal Combustion Engine Modeling
ME 7506	Advanced Fluid Dynamics
ME 7510	Advanced Heat Transfer
ME 7511	Computational Fluid Dynamics
ME 7518	Advanced Analytical Methods in Mechanical Engineering
ME 7526	Advanced Combustion
ME 7527	Jet Propulsion
ME 7538	Advanced Nuclear Reactor Thermal Hydraulics
ME 8503	Statistical Thermodynamics
ME 8504	Physical Gas Dynamics
ME 8514	Optical Techniques for Flow Measurements
AAE 5615	Introduction to Computational Fluid Dynamics
AAE 5645	Introduction to Structure Dynamics and Aeroelasticity of Aerospace Vehicles
AAE 5751	Advanced Air-Breathing Propulsion
AAE 5752	Advanced Rocket Propulsion
AAE 5771	Viscous Fluid Flow: Laminar and Transitional
AAE 5775	Hypersonic Flows
AAE 6860	Experimental Fluid Dynamics
AAE 7862	Internal Flow in Turbomachinery
AAE 8851	Advanced Propulsion Problems
AAE 8873	Computational Fluid Dynamics

APPENDIX II: AAE PROGRAM EQUIVALENT COURSES

ME Courses to Count as “Program Equivalent Courses” for the Aerospace Engineering Graduate Program.

Structures

ME 5068 - Introduction to the Finite Element Method
ME 5139 - Applied Finite Element Method
ME 5144 - Engineering Fracture Mechanics
ME 5162 - Introduction to Laminated Composite Materials
ME 7040 - Elasticity
ME 7100 - Introduction to Continuum Mechanics
ME 7101 - Constitutive Models in Continuum Mechanics
ME 7163 - Advanced Strength of Materials and Elasticity Theory
ME 8100 - Advanced Topics in Continuum Mechanics
ME 8230 - Nonlinear Dynamics

Fluids

ME 6505 - Intermediate Fluid Dynamics
ME 6507 - Intermediate Numerical Methods
ME 6510 - Intermediate Heat and Mass Transfer
ME 6515 - Intro to Micro and Nanofluidics
ME 6526 - Combustion
ME 7510 - Advanced Heat Transfer
ME 7511 - Computational Fluid Dynamics
ME 7513 - Turbulence
ME 7520 - Wave Dynamics in Fluids
ME 7526 - Advanced Combustion
ME 7538 - Advanced Nuclear Reactor Thermal Hydraulics
ME 8503 - Statistical Thermodynamics
ME 8504 - Physical Gas Dynamics
ME 8514 - Optical Techniques for Flow Measurements

Dynamics and Controls

ME 5240 - Vibration and Acoustic Design
ME 5372 - Design and Control of Mechatronic Systems
ME 7230 - Advanced Dynamics
ME 7250 - Vibrations in Discrete Systems
ME 7290 - Digital Control Engineering
ME 7292 - Control System Labs
ME 7380 - Lumped Parameter Modeling and Systems Analysis
ME 8250 - Vibrations of Continuous Systems
ME 8260 - Advanced Engineering Acoustics

APPENDIX III: SUGGESTED COURSES FOR THE MATH REQUIREMENT

Note: Any courses listed below can count towards the Math requirement.

COURSE NO.	COURSE TITLE
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

MATH EQUIVALENCY COURSES FOR MAE GRADUATE STUDENTS	
COURSE NO.	COURSE TITLE
ME 6507	Intermediate Numerical Methods
ECE 6750	Linear System Theory
ECE 6754	Nonlinear Systems Theory
ME 7518	Advanced Analytical Methods in Mechanical Engineering

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