Arizona State University

Master’s Level Graduate Study in Mechanical and Aerospace Engineering

Master of Science in Engineering (MSE) & Master of Science (MS)
(revised August, 2011)

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Master's Level Graduate Study in Mechanical and Aerospace Engineering

1. Overview
The graduate programs in Mechanical and Aerospace Engineering accommodate individual interests, and encourage independent and innovative study. Students are part of a diverse intellectual community dedicated to advancing the state of the art and practice of mechanical or aerospace engineering. The School for Engineering of Matter, Transport and Energy (SEMTE) offers the following graduate degrees in Aerospace Engineering:

- Master of Science (MS)—non-thesis/comprehensive exam option
- Master of Science (MS)—non-thesis/applied project option
- Master of Science (MS)—thesis option
- Masters in Passing (MIP)
- Doctor of Philosophy (PhD)
- Doctor of Philosophy with an Engineering Education concentration (PhD)
- 4+1 accelerated degrees between our BSE and MS (available only to current ASU undergraduates)

SEMTE currently offers the following graduate degrees in Mechanical Engineering:

- Master of Science in Engineering (MSE)—non-thesis/comprehensive exam option
- Master of Science in Engineering (MSE)—non-thesis/applied project option
- Master of Science (MS)—thesis option
- Masters in Passing (MIP)
- Doctor of Philosophy (PhD)
- Doctor of Philosophy with an Engineering Education concentration (PhD)
- 4+1 accelerated degrees between our BSE and MS (available only to current ASU undergraduates)

This document describes only the master’s level degrees.

All of the programs stress a sound foundation in technical fundamentals, communication and professionalism. The MS and MSE degree programs prepare engineers for doctoral study or industrial positions that specialize in research, project management and product innovation. The doctoral program emphasizes original research and provides students with a strong background for employment by academic institutions, government laboratories and industrial research laboratories. The School offers a broad-based curriculum in design, systems and control; fluid mechanics science and engineering; mechanics and dynamics of solids; and transport phenomena, thermodynamics, and energy. Several interdisciplinary programs are also accessible. Modern computational and laboratory facilities are available to support timely research investigations. The following sections provide information about program requirements, policies, and curriculum.

2. Admissions Policy
It is the goal of the School to achieve balance, to the extent possible, between domestic and international students. The School will strive to achieve a representative population of under-represented groups as candidates for advanced degrees. All applicants who have complete applications and meet admission standards will be reviewed.
2.a. Admission Requirements
A minimum grade point average of 3.0 (on a 4.0 scale) is required for graduates of accredited United States institutions. ASU’s Graduate College is responsible for international grade point average interpretation.

All applicants are required to take the general Graduate Record Examination (GRE); a subject-specific GRE is not required.

Students who do not have English as their primary language are required to achieve minimum competencies. Please see http://graduate.asu.edu/admissions/international/english_proficiency for additional information and minimum score requirements.

Three letters of recommendation are required, using the on-line recommendation system. Applicants will enter in the recommenders’ contact information during the application. Recommenders will be sent an electronic letter of recommendation once the application fee has been paid.

All applicants are required to submit a statement of academic and career objectives and address the desire to pursue graduate studies at Arizona State University in the School for Engineering of Matter, Transport, and Energy (Statement of Purpose). This will be uploaded at the time of application and is highly recommended to be in .PDF format.

Additional information regarding admission can be found at: http://graduate.asu.edu/admissions.

2.b. Application Process
Apply to Arizona State University using the on-line application system at http://graduate.asu.edu/admissions. You may pay the application fee on-line using a credit card. The Graduate College will not process your application until the application fee has been paid.

Have official transcripts sent from all institutions attended to:

Arizona State University
Graduate College
Interdisciplinary Building, B-Wing, Room 170
P.O. Box 871003
Tempe, Arizona 85287-1003

Official test scores (GRE and TOEFL) must be sent electronically directly from ETS using institution code 4007; leave the department code blank.

2.c. Application Status
You may check the status of your application by logging on to My.ASU.edu. You may contact SEMTE graduate personnel at semte@asu.edu if you have questions regarding your application; please make sure to include your full name, ASU ID 10-digit ID number, semester, and program for which you are applying in all correspondence.

Note: Please be sure that your full name appears exactly the same on all documents. Documents varying in name will not be linked together and will therefore be considered as incomplete.

3. Financial Support Policy
The School will allocate a limited number of graduate assistantships each year. The following guidelines will be used to determine the recipients of this support.

i) All financial support will be based on merit. Criteria used to determine merit will be the applicant's GPA, GRE scores, TOEFL score (if applicable), letters of recommendation and Statement of Purpose. An online form is available for application for a teaching assistantship. To be considered for a research...
assistantship, applicants should contact faculty members listed as mechanical or aerospace engineering graduate faculty, as research assistantships are decided by individual faculty members.

ii) The decision as to whom will receive School financial support (i.e., from the general School fund) will be determined by the School’s service needs (e.g., teaching assistants). All graduate students on School support will be assigned appropriate teaching-related duties. International students must pass the SPEAK test with a minimum score of 55 to be eligible for School teaching assistantships.

iii) The decision as to whom will receive support from research grants and contracts will reside with the principal investigator from whose funds the student will be paid. Students may contact individual faculty to see what opportunities may exist.

v) Students making satisfactory academic and program progress (see Section 6), subject to the availability of funds, are eligible to receive a maximum of three semesters of School support (a teaching assistantship) as MS/MSE candidates and five semesters of School support as PhD candidates. Students on academic probation or new provisionally admitted students are not eligible for School support.

vi) Students receiving financial aid must register for 12 hours of credit each semester in total; these hours may include research and dissertation credits. These students must also register for MAE 594 Graduate Research Conference. Note that an audited course does not count toward the 12 hours and requires a petition to the School. If a student on a TA/RA position falls below 12 credit hours during the semester, the School has the right to revoke the TA/RA position and benefits. The 12-credit-hour registration requirement is only for the fall/spring. Students receiving a TA/RA position in the summer sessions must be enrolled in at least one credit hour.

4. Graduate Programs

4.a. Graduate Courses

Graduate course offerings in the School cover the classical areas, including aerodynamics and fluid mechanics, design and manufacturing, heat transfer and thermodynamics, solid mechanics and dynamics, and system dynamics and control as well as interdisciplinary topics in micro- and nanotechnology and sustainability. A list of current course offerings in these areas is given in Appendix A. Students must also satisfy a mathematics requirement. Courses that may be used to satisfy this requirement are also listed in Appendix A.

Only graduate courses (500 level and above) will count toward the course requirements of the MS and MSE degrees. Courses below the 500 level cannot be listed on the iPOS. Audited courses do not apply toward the degree program and cannot be listed on the iPOS. In general SEMTE graduate students are not granted permission to audit a course until the student has filed a Plan of Study (iPOS) and has completed all coursework on the iPOS.

4.b. Master of Science in Engineering (MSE) (Mechanical Engineering)

The MSE degree is the default master’s degree in mechanical engineering. Full-time students can complete the degree program in 12 months, per the example curricula provided in Appendix B. The University requirements for the Master of Science in Engineering (MSE) degree are given in the ASU Academic Catalog. MSE students can choose to take either a comprehensive exam or carry out an applied project under the supervision of a member of the ME Graduate Faculty. Students must select a program committee chair prior to completing 15 credit hours. For students taking the comprehensive exam, the program committee chair will normally be the MAE Graduate Program Chair, while students
carrying out an applied project will normally select the project supervisor as the program committee chair. The name of the student's program committee chair must be filed with the School's Graduate Programs Office through the filing of a Plan of Study (iPOS). A change of program committee chair requires approval of the Graduate Program Chair.

Prior to beginning the second semester of study (spring or fall, not counting the summer), the student, in consultation with the program committee chair, must file a plan of study (iPOS) with the University through the MyASU system. The program committee chair and the Graduate Program Chair must approve changes to the iPOS. It is the student's responsibility to ensure that the transcript and the iPOS are synchronized through a course change petition, to obtain the program committee chair's approval of any changes, and to submit all documentation to the graduate advisor.

**Note:** The University will block registration for students who have completed 15 credit hours and have not filed an iPOS. The registration block will not be removed from the student's account until an iPOS has been filed and approved by the School, the Graduate College and the Graduation Office.

The iPOS must be in accordance with University, School, and program requirements. Candidates for the MSE degree must complete a minimum of 30 semester hours of course work as described below. For students currently enrolled in a master's degree program at another institution and wishing to transfer to ASU, a maximum of six (6) credit hours may be counted toward an MSE degree at Arizona State University as elective hours. Coursework completed and used towards a previously awarded degree is not permitted to be listed on the iPOS. A minimum cumulative grade point average of 3.0 is required throughout the program.

The 30 credit hours consist of the following:

- At least fifteen (15) credit hours of graduate MAE coursework (500 level and above). Graduate non-MAE courses may be substituted, upon the approval of the MAE Graduate Affairs Committee.
- At least six (6) credit hours of graduate mathematics-oriented courses (500 level and above). Students are strongly encouraged to take MAE 501 Linear Algebra in Engineering and MAE 502 Partial Differential Equations in Engineering. The list of acceptable mathematics courses is given in Appendix A. Note that any MAE courses, such as MAE 501 and MAE 502, that are counted as mathematics-oriented courses cannot be “double-counted” towards the fifteen (15) credit hours of graduate MAE coursework.
- At least nine (9) credit hours of additional graduate courses; these may be either MAE or non-MAE courses, and are not restricted to science, mathematics, or engineering. A maximum of three (3) credit hours of MAE 584 Internship may be counted towards this requirement. A combined maximum of six (6) credit hours of MAE 591 Seminar, MAE 594 Graduate Research Conference, or MAE colloquium classes may be counted towards this requirement. For students carrying out an applied project, a maximum of six (6) credit hours of MAE 593 Applied Project can count towards this requirement.

Note: MSE students carrying out an applied project must include at least 3 credit hours of MAE 593 Applied Project on their iPOS.

For students choosing to take the comprehensive exam, this exam will be administered three (3) times per year, at the end of the fall, spring, and summer semesters. This exam will be open book, open notes, and will consist of questions from mathematics and from the student’s choice of two of the following core disciplines in mechanical and aerospace engineering:
<table>
<thead>
<tr>
<th>Subject</th>
<th>Representative Classes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Controls</td>
<td>MAE 506 Advanced System Modeling, Dynamics, &amp; Control</td>
</tr>
<tr>
<td></td>
<td>MAE 507 Optimal Control</td>
</tr>
<tr>
<td></td>
<td>MAE 547 Mechanical Design and Control of Robots</td>
</tr>
<tr>
<td>Design</td>
<td>MAE 540 Advanced Product Design Methodology</td>
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<td>MAE 541 CAD Tools for Engineers</td>
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<td></td>
<td>MAE 544 Mechanical Design and Failure Prevention</td>
</tr>
<tr>
<td></td>
<td>MAE 546 Advanced CAE Simulation</td>
</tr>
<tr>
<td>Dynamics</td>
<td>MAE 506 Advanced System Modeling, Dynamics, &amp; Control</td>
</tr>
<tr>
<td></td>
<td>MAE 510 Dynamics and Vibrations</td>
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<td></td>
<td>MAE 512 Random Vibrations</td>
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<td></td>
<td>MAE 515 Structural Dynamics</td>
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<tr>
<td>Fluid Mechanics/Aerodynamics</td>
<td>MAE 504 Experimental Processes for Thermal and Fluid Processes</td>
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<td></td>
<td>MAE 561 Computational Fluid Dynamics</td>
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<td></td>
<td>MAE 564 Advanced Aerodynamics</td>
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<td></td>
<td>MAE 566 Rotary-Wing Aerodynamics</td>
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<td></td>
<td>MAE 571 Fluid Mechanics</td>
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<td></td>
<td>MAE 572 Advanced High-Speed Flows</td>
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<td>MAE 573 Viscous Fluid Flow</td>
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<td>MAE 574 Fluid Transport in Micro/Nanoscale Devices</td>
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<td>MAE 575 Turbulence</td>
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<td>MAE 577 Turbulent Flow Modeling</td>
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<td>MAE 578 Environmental Fluid Dynamics</td>
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<tr>
<td>Thermodynamics/Heat and Mass Transfer</td>
<td>MAE 504 Experimental Processes for Thermal and Fluid Processes</td>
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<td></td>
<td>MAE 536 Combustion</td>
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<td></td>
<td>MAE 581 Advanced Thermodynamics</td>
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<td>MAE 585 Conduction Heat Transfer</td>
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<td></td>
<td>MAE 586 Convection Heat Transfer</td>
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<td></td>
<td>MAE 587 Radiation Heat Transfer</td>
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<td></td>
<td>MAE 589 Heat and Mass Transfer</td>
</tr>
<tr>
<td>Math</td>
<td>MAE 501 Linear Algebra in Engineering</td>
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<td></td>
<td>MAE 502 Partial Differential Equations in Engineering</td>
</tr>
<tr>
<td></td>
<td>MAE 505 Perturbation Methods</td>
</tr>
<tr>
<td></td>
<td>IEE 572 Design Engineering Experiments</td>
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<tr>
<td>Solid Mechanics</td>
<td>MAE 520 Stress Analysis</td>
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<td>MAE 521 Structural Optimization</td>
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<td>MAE 523 Fracture Mechanics</td>
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<td></td>
<td>MAE 524 Theory of Elasticity</td>
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<td></td>
<td>MAE 525 Mechanics of Smart Materials &amp; Devices</td>
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<td></td>
<td>MAE 527 Finite Elements for Engineers</td>
</tr>
<tr>
<td></td>
<td>MAE 557 Mechanics of Composite Materials</td>
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</table>

Students will be tested only on courses that they have taken. The comprehensive exam is pass/fail, and a cumulative passing score of 60% is required for graduation. If a student fails the comprehensive exam, he/she can repeat the test the next time it is offered (i.e., the following semester), provided the student enrolls in at least one (1) credit hour of MAE 595 Continuing Registration, and provided a successful petition is filed by the student and is approved by the Graduate College. Per Graduate College guidelines, the comprehensive exam may be retaken only once. Students who fail the comprehensive exam twice are subject to removal from the program for not making satisfactory academic progress.
For students choosing to carry out an applied project, in consultation with the program committee chair the student must prepare a written report, in the form of an ASME-style conference paper or equivalent, and deliver a short oral presentation. The Program Committee will consist of only the Program Committee Chair, i.e., the faculty advisor. The Program Committee Chair will be solely responsible for judging the quality of the report and oral presentation, and determining if they are satisfactory to serve as the required culminating event for the MSE degree.

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### 4.c. Master of Science (MS)—non-thesis option (Aerospace Engineering)

The MS—non-thesis degree is the default master’s degree in aerospace engineering, and two tracks are available:

- MS—non-thesis/comprehensive exam
- MS—non-thesis/applied project

It is anticipated that most MS—non-thesis students in Aerospace Engineering will take a comprehensive exam, rather than carry out an applied project.

Full-time students can complete the degree program in 12 months, per the example curricula provided in Appendix B. The University requirements for the Master of Science—non-thesis (MS) degree are given in the ASU Academic Catalog. MS—non-thesis students can choose to take either a comprehensive exam or carry out an applied project under the supervision of a member of the AE Graduate Faculty. Students must select a program committee chair prior to completing 15 credit hours. For students taking the comprehensive exam, the program committee chair will normally be the MAE Graduate Program Chair, while students carrying out an applied project will normally select the project supervisor as the program committee chair. The name of the student’s program committee chair must be filed with the School’s Graduate Programs Office through the filing of a Plan of Study (iPOS). A change of program committee chair requires approval of the Graduate Program Chair.

Prior to beginning the second semester of study (spring or fall, not counting the summer), the student, in consultation with the program committee chair, must file a plan of study (iPOS) with the University through the MyASU system. The program committee chair and the Graduate Program Chair must approve changes to the iPOS. It is the student’s responsibility to ensure that the transcript and the iPOS are synchronized through a course change petition, to obtain the program committee chair’s approval of any changes, and to submit all documentation to the graduate advisor.

**Note:** The University will block registration for students who have completed 15 credit hours and have not filed an iPOS. The registration block will not be removed from the student’s account until an iPOS has been filed and approved by the School, the Graduate College and the Graduation Office.

The iPOS must be in accordance with University, School, and program requirements. Candidates for the MSE degree must complete a minimum of 30 semester hours of course work as described below. For students currently enrolled in a master’s degree program at another institution and wishing to transfer to ASU, a maximum of six (6) credit hours may be counted toward an MS degree at Arizona State University as elective hours. Coursework completed and used towards a previously awarded degree is not permitted to be listed on the iPOS. A minimum cumulative grade point average of 3.0 is required throughout the program.

The 30 credit hours consist of the following:

- At least fifteen (15) credit hours of graduate MAE coursework (500 level and above). Graduate non-MAE courses may be substituted, upon the approval of the MAE Graduate Affairs Committee.
• At least six (6) credit hours of graduate mathematics-oriented courses (500 level and above). Students are strongly encouraged to take MAE 501 Linear Algebra in Engineering and MAE 502 Partial Differential Equations in Engineering. The list of acceptable mathematics courses is given in Appendix A. Note that any MAE courses, such as MAE 501 and MAE 502, that are counted as mathematics-oriented courses cannot be “double-counted” towards the fifteen (15) credit hours of graduate MAE coursework.

• At least nine (9) credit hours of additional graduate courses; these may be either MAE or non-MAE courses, and are not restricted to science, mathematics, or engineering. A maximum of three (3) credit hours of MAE 584 Internship may be counted towards this requirement. A combined maximum of six (6) credit hours of MAE 591 Seminar, MAE 594 Graduate Research Conference, or MAE colloquium classes may be counted towards this requirement. For students carrying out an applied project, a maximum of six (6) credit hours of MAE 593 Applied Project can count towards this requirement.

Note: MSE students carrying out an applied project must include at least 3 credit hours of MAE 593 Applied Project on their iPOS.

For students choosing to take the comprehensive exam, this exam will be administered three (3) times per year, at the end of the fall, spring, and summer semesters. This exam will be open book, open notes, and will consist of questions from mathematics and from the student’s choice of two of the following core disciplines in mechanical and aerospace engineering:

<table>
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<th>Subject</th>
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| Controls | MAE 506 Advanced System Modeling, Dynamics, & Control  
| | MAE 507 Optimal Control  
| | MAE 547 Mechanical Design and Control of Robots  |
| Design | MAE 540 Advanced Product Design Methodology  
| | MAE 541 CAD Tools for Engineers  
| | MAE 544 Mechanical Design and Failure Prevention  
| | MAE 546 Advanced CAE Simulation  |
| Dynamics | MAE 506 Advanced System Modeling, Dynamics, & Control  
| | MAE 510 Dynamics and Vibrations  
| | MAE 512 Random Vibrations  
| | MAE 515 Structural Dynamics  |
| Fluid Mechanics/Aerodynamics | MAE 504 Experimental Processes for Thermal and Fluid Processes  
| | MAE 561 Computational Fluid Dynamics  
| | MAE 564 Advanced Aerodynamics  
| | MAE 566 Rotary-Wing Aerodynamics  
| | MAE 571 Fluid Mechanics  
| | MAE 572 Advanced High-Speed Flows  
| | MAE 573 Viscous Fluid Flow  
| | MAE 574 Fluid Transport in Micro/Nanoscale Devices  
| | MAE 575 Turbulence  
| | MAE 577 Turbulent Flow Modeling  
| | MAE 578 Environmental Fluid Dynamics  |
| Thermodynamics/Heat and Mass Transfer | MAE 504 Experimental Processes for Thermal and Fluid Processes  
| | MAE 536 Combustion  
| | MAE 581 Advanced Thermodynamics  
| | MAE 585 Conduction Heat Transfer  |
Students will be tested only on courses that they have taken. The comprehensive exam is pass/fail, and a cumulative passing score of 60% is required for graduation. If a student fails the comprehensive exam, he/she can repeat the test the next time it is offered (i.e., the following semester), provided the student enrolls in at least one (1) credit hour of MAE 595 Continuing Registration, and provided a successful petition is filed by the student and is approved by the Graduate College. Per Graduate College guidelines, the comprehensive exam may be retaken only once.

For students choosing to carry out an applied project, in consultation with the program committee chair the student must prepare a written report, in the form of an ASME-style conference paper or equivalent, and deliver a short oral presentation. The Program Committee will consist of only the Program Committee Chair, i.e., the faculty advisor. The Program Committee Chair will be solely responsible for judging the quality of the report and oral presentation, and determining if they are satisfactory to serve as the required culminating event for the MSE degree.

4.d. Master of Science (MS)—thesis option (Aerospace or Mechanical Engineering)

The University requirements for the Master of Science (MS) degree are given in the ASU Graduate Catalog. The MS—thesis option is the School’s research master's degree; majors in Aerospace Engineering and Mechanical Engineering are available. A member of the ME or AE Graduate Faculty must agree to serve as the program committee chair (faculty advisor) for a student to be admitted or be transferred to the MS program. The graduate advisor will need to have confirmation from the faculty member agreeing to serve as the thesis chair prior to a plan change being made to move into the MS degree.

The name of the student's program committee chair must be filed with the School’s Graduate Programs Office through being listed on the Plan of Study. A change of program committee chair requires approval of the Graduate Program Chair.

The program committee chair, in consultation with the student, will establish a Master of Science Program Committee (MSPC). The MSPC shall be composed of a minimum of three members from the ASU faculty with at least two being from the ME or AE Graduate Faculty. Participation of individuals from institutions external to ASU is encouraged but these may be non-voting members as determined at the discretion of the program chair.

Prior to completing 15 credit hours, the student, in consultation with the program committee chair, must file a plan of study (IPOS) with the University through the MyASU portal. The MSPC and the Graduate Program Chair must approve changes to the IPOS. It is the student’s responsibility to ensure
that the transcript and the iPOS are synchronized through a course change petition, to obtain the program committee chair’s approval of any changes, and to submit all documentation to the graduate advisor.

**Note:** The University will block registration for students who have completed 15 credit hours and have not filed an iPOS. The registration block will not be removed from the student’s account until an iPOS has been filed and approved by the School, the Graduate College and the Graduation Office.

The iPOS must be in accordance with University, School, and program requirements. Candidates for the MS degree must complete a minimum of 30 semester credit hours of course and thesis work distributed below. For students currently enrolled in a master’s degree program at another institution and wishing to transfer to ASU, note that a maximum of six (6) credit hours may be counted towards an MS degree at Arizona State University. Coursework completed and used towards a previously awarded degree is not permitted to be listed on the iPOS. A minimum cumulative grade point average of 3.0 is required throughout the program.

The 30 credit hours consist of the following:

- At least twelve (12) credit hours of graduate MAE coursework (500 level and above). Graduate non-MAE courses may be substituted, upon the approval of the MAE Graduate Affairs Committee.

- At least six (6) credit hours of graduate mathematics-oriented courses (500 level and above). Students are strongly encouraged to take MAE 501 Linear Algebra in Engineering and MAE 502 Partial Differential Equations in Engineering. The list of acceptable mathematics courses is given in Appendix A. Note that any MAE courses, such as MAE 501 and MAE 502, that are counted as mathematics-oriented courses cannot be “double-counted” towards the twelve (12) credit hours of graduate MAE coursework.

- At least six (6) credit hours of additional graduate courses; these may be either MAE or non-MAE courses, and are not restricted to science, mathematics, or engineering. A maximum of three (3) credit hours of MAE 584 Internship may be counted towards this requirement. A combined maximum of six (6) credit hours of MAE 591 Seminar, MAE 594 Graduate Research Conference, or MAE colloquium classes, such as MAE 580 Solar Energy Colloquium, may be counted towards this requirement.

- Six (6) hours of MAE 599 Thesis exactly.

A final public defense of the thesis will be administered by the MSPC.

**4.e. Integrated Bachelor of Science in Engineering--Master of Science (BSE-MS)**

This program is designed to provide selected high-achieving ASU Mechanical and Aerospace Engineering undergraduate students with the opportunity to combine advanced undergraduate coursework with graduate coursework and accelerate graduate degree completion. Students will be able to earn a BSE and an MSE (mechanical engineering only) or MS degree in five (5) years by completing and sharing up to nine (9) credit hours of graduate-level MAE coursework completed with a “B” grade or above taken as technical electives during the junior and/or senior years. These credits will apply toward both the undergraduate and graduate degrees. An additional nine (9) credit hours maximum can be reserved for credit towards the MS/MSE degree as taken during the undergraduate degree program, but cannot be counted towards the undergraduate degree. All coursework must be completed with a grade of “B” or above.

A minimum ASU cumulative grade point average of 3.5 is required. Contact the School’s graduate programs personnel for additional information and application materials.
4.f. Masters in Passing (MIP)
Students who are enrolled in the Mechanical or Aerospace Engineering PhD program and who do not have a previously earned MS or MSE degree may apply for a Masters in Passing (MIP) upon completion of 30 hours of appropriate graduate coursework and separate culminating experience. The MIP requires a separate iPOS from the PhD and all grades must be entered before the MIP can be awarded. Contact the School’s graduate programs personnel for additional information.

5. Milestones and Timeline
5.a. MSE Degree (Mechanical Engineering), or MS—Non-Thesis Degree (Aerospace Engineering)
   i) File Plan of Study – prior to beginning of second semester of study (spring or fall only, not counting the summer)
   ii) Select applied project option or comprehensive exam option. If choosing to carry out an applied project, the student must first identify a member of the mechanical or aerospace engineering graduate faculty to supervise the project.
   iii) Apply for graduation – please see the Academic Calendar for deadlines at: http://students.asu.edu/academic-calendar
   iv) For students choosing to carry out an applied project, submit a completed “Schedule Defense Room Reservation Form” to the Graduate Advisor 15 working days prior to the presentation to reserve a room.
   v) Complete Part I, and bring the Report of Final Masters Culminating Experience (http://engineering.asu.edu/semte/GradForms.html) to the comprehensive exam or the applied project presentation.
   vi) Take and pass the comprehensive exam, or present the results of the applied project on the designated day in the intended semester of graduation. Normally, the comprehensive exam will be administered, and the applied project oral presentations will be given, on reading day (the day between the end of classes and the start of final exams).
   vii) Bring the Report of Final Masters Culminating Experience document with the signatures of the committee to the graduate advisor for School processing.
   viii) Commencement date – See academic calendar.

Note: MSE (mechanical engineering) or MS-non-thesis (aerospace engineering) students must maintain consecutive semester enrollment. If a student does not register for at least one credit hour during a semester, an application for re-admission to the MSE degree program is required. All degree requirements must be completed in six consecutive years from the time of admission.

5.b. MS—Thesis Degree (Aerospace or Mechanical Engineering)
   i) Identify a thesis advisor from the MAE Graduate Faculty. This should be done as soon as possible, but no later than the second semester of study.
   ii) File Plan of Study – prior to beginning of second semester of study (spring or fall only, not counting the summer).
   iii) Apply for graduation – please see the Academic Calendar for deadlines at: http://students.asu.edu/academic-calendar
   iv) Submit a completed “Schedule Defense Room Reservation Form” to the Graduate Advisor 15 working days prior to the defense to reserve a room.
   v) Schedule the defense through the MyASU system after having approval from the Graduate Advisor business days before defense date (consult 10-day calendar on the Graduate College website http://graduate.asu.edu/graddeadlines.html).
vi) Submit thesis for format approval to gradformat@asu.edu – please see the Graduate College deadlines and procedures for additional information: http://graduate.asu.edu/graddeadlines.html

vii) Submit thesis title, date/time/location of defense, and abstract to the graduate advisor for internal posting.

viii) Hold oral defense of thesis – must be completed by the last day to defend a thesis date.

ix) Submit pass/fail form to the Graduate Advisor for School processing immediately after the defense, regardless of outcome.

x) Pick up the pass/fail form from the Graduate Advisor with the head of the academic unit’s signature and take to the Graduate College.

xi) Submit thesis to Proquest electronically when directed by the Graduate College.

xii) Bring the Graduate Advisor a copy of your Proquest submission for any outstanding “Z” grades to be changed to “Y”.

xiii) Commencement date – See academic calendar.

**Note:** Maximum time limit – All degree requirements, including the oral defense of thesis and any necessary revisions, must be completed within six (6) consecutive years from the semester of admission.

**Note:** MS students must maintain consecutive semester enrollment. If a student does not register for at least one credit hour during a semester, an application for re-admission to the MS degree program is required.

6. Satisfactory Standing

All MS and MSE students must maintain a minimum cumulative, graduate, and iPOS GPA of 3.00 in course work approved under their plan of study to maintain good standing. Ira A. Fulton School of Engineering guidelines on retention are to be strictly enforced; see Appendix C.

7. Graduate Student Advising

For initial advising, incoming students will report to the Graduate Program Chair who may arrange for a temporary advisor based on the student’s stated area of interest. The initial faculty advisor should be considered temporary until such time as a permanent PC chair is designated. Otherwise, the Graduate Program Chair is the default advisor for all MSE students. If a particular faculty member on a research grant or contract is directly supporting an incoming student, that faculty person will be the PC chair. The graduate advisor can assist with the process towards completing the degree, not academic content (i.e. registration, iPOS questions).

8. Graduate Course Offerings (Appendix A)

Listed below are the graduate course offerings in a given research area. A full description of the courses is provided in the ASU catalog. Course selection must be determined in consultation with the PC chair.

8.a. Design, Systems and Control:

- MAE 506 Advanced System Modeling, Dynamics and Control
- MAE 507 Optimal Control
- MAE 527 Finite Elements for Engineers
- MAE 540 Advanced Product Design Methodology
- MAE 541 CAD Tools for Engineers
MAE 544 Mechanical Design and Failure Prevention
MAE 546 Advanced CAE Simulation
MAE 547 Mechanical Design and Control of Robots

8.b. Fluid Mechanics Science and Engineering:
MAE 504 Experimental Methods in Thermal and Fluid Processes
MAE 527 Finite Elements for Engineers
MAE 536 Combustion
MAE 561 Computational Fluid Dynamics
MAE 564 Advanced Aerodynamics
MAE 566 Rotary-Wing Aerodynamics
MAE 571 Fluid Mechanics
MAE 572 Advanced High-Speed Flows
MAE 573 Viscous Fluid Flow
MAE 574 Fluid Transport in Micro/Nanoscale Devices
MAE 575 Turbulence
MAE 577 Turbulent Flow Modeling
MAE 578 Geophysical and Environmental Fluid Dynamics

8.c. Mechanics and Dynamics of Solids:
MAE 510 Dynamics and Vibrations
MAE 512 Random Vibrations
MAE 515 Structural Dynamics
MAE 520 Stress Analysis
MAE 521 Structural Optimization
MAE 523 Fracture Mechanics
MAE 524 Theory of Elasticity
MAE 525 Mechanics of Smart Materials and Structures
MAE 527 Finite Elements for Engineers
MAE 557 Mechanics of Composite Materials

8.d. Transport Phenomena, Thermodynamics and Energy:
MAE 504 Experimental Methods in Thermal and Fluid Processes
MAE 527 Finite Elements for Engineers
MAE 536 Combustion
MAE 561 Computational Fluid Dynamics
MAE 581 Advanced Thermodynamics
MAE 585 Conduction Heat Transfer
MAE 586 Convection Heat Transfer
MAE 587 Radiation Heat Transfer
MAE 589 Heat and Mass Transfer

8.e. Mathematics Electives:
MAE 501 Linear Algebra in Engineering
MAE 502 Partial Differential Equations in Engineering
MAE 505 Perturbation Methods
MAT 500 level or above courses
APM 500 level or above courses
STP 500 level or above courses
PHY 501 Methods of Computational and Theoretical Physics
PHY 502 Methods of Theoretical Physics
EEE 550 Transform Theory and Applications
IEE 572 Design Engineering Experiments

9. Sample Curricula for the MSE Program (Appendix B)
The following curricula are meant to serve as examples for full-time MSE (mechanical engineering) or MS—non-thesis (aerospace engineering) students who desire to take the comprehensive exam for degree completion. Note that these are only examples; course substitutions are allowed. Students choosing to undertake an applied project can replace up to six (6) credit hours with MAE 593 Applied Project.

10.a. Design, Systems and Control

<table>
<thead>
<tr>
<th>Fall Semester</th>
<th>Spring Semester</th>
<th>Summer Sessions</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAE 501 Linear Algebra in Engineering (3)</td>
<td>MAE 541 CAD Tools for Engineers (3)</td>
<td>MAE 507 Optimal Control (3)</td>
</tr>
<tr>
<td>MAE 527 Finite Elements for Engineers (3)</td>
<td>MAE 598 Advanced CAE Simulation (3)</td>
<td>MAE 502 Partial Differential</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Equations in Engineering (3)</td>
</tr>
<tr>
<td>MAE 598 Smart Material Systems (3)</td>
<td>MAE 540 Advanced Product Design Methodology (3)</td>
<td></td>
</tr>
<tr>
<td>MAE 591 Science Policy for Scientists &amp; Engineers (1)</td>
<td>MAE 580 Solar Energy Colloquium (3)</td>
<td></td>
</tr>
<tr>
<td>MAE 594 Graduate Research Conference (1)</td>
<td>MAE 594 Graduate Research Conference (1)</td>
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</table>

10.b. Fluid Mechanics Science and Engineering

<table>
<thead>
<tr>
<th>Fall Semester</th>
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</tr>
</thead>
<tbody>
<tr>
<td>MAE 571 Fluid Mechanics (3)</td>
<td>MAE 561 Computational Fluid Dynamics (3)</td>
<td>MAE 589 Heat and Mass Transfer (3)</td>
</tr>
<tr>
<td>MAE 578 Geophysical &amp; Environmental Fluid Dynamics (3)</td>
<td>MAE 575 Turbulence (3)</td>
<td>MAE 501 Linear Algebra in Engineering (3)</td>
</tr>
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<td>MAE 502 Partial Differential</td>
<td>MAE 564 Advanced</td>
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</table>
10.c. Mechanics and Dynamics of Solids

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<th>Fall Semester</th>
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<tr>
<td>MAE 520 Stress Analysis (3)</td>
<td>MAE 515 Structural Dynamics (3)</td>
<td>MAE 501 Linear Algebra in Engineering (3)</td>
</tr>
<tr>
<td>MAE 502 Partial Differential Equations in Engineering (3)</td>
<td>MAE 523 Fracture Mechanics (3)</td>
<td>MAE 524 Theory of Elasticity (3)</td>
</tr>
<tr>
<td>MAE 557 Mechanics of Composite Materials (3)</td>
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<tr>
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10.d. Transport Phenomena, Thermodynamics and Energy

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11. Academic Standards (Appendix C)

**Policy for Maintaining Academic Satisfactory Progress**

A student who has been admitted to an MS or MSE degree program in Mechanical or Aerospace Engineering, with either regular or provisional admission status, must maintain a 3.0 or higher grade point average (GPA) as stated below:

1. In all work taken for graduate credit (courses numbered 500 or higher);
2. In the coursework on the student’s approved plan of study, and
3. In all post baccalaureate coursework taken at ASU (overall GPA).

A. A student will be placed on academic probation if:

   o One or more of the student's GPAs listed above falls below 3.0 (MS or MSE);
   o Or the student receives a grade of D or E in a course at the 400 level or above;
   o If a student does not successfully complete the milestones as required for the degree (i.e. passing comprehensive exams in the semester outlined in the student handbook).

Students will be notified by mail when placed on academic probation.
B. A student will return to academic good standing by obtaining a minimum 3.0 (MS or MSE) in the GPAs listed above by the time the next nine hours are completed. Coursework such as research and thesis/dissertation registration that are for Z or Y grade, 400 level coursework, and audit courses cannot be included in these nine hours. The next nine (9) credit hours must be completed the semester following the semester that the student is placed on academic probation, for full-time students. For part-time students, the next nine (9) credit hours must be completed within three (3) semesters following the semester that the student is placed on academic probation.

C. A student may be recommended for dismissal from a graduate program if:
   - The student fails to increase all of the GPAs listed above to a minimum of 3.0 (MS or MSE) or 3.25 (PhD) by the time he/she completes the next nine credit hours as defined in section B;
   - Or the student receives a grade of D or E while on academic probation for any reason;
   - Or a provisionally admitted student fails to meet the required provision(s) of admission;
   - Does not successfully meet the program milestones
   - Fails comprehensive exams or culminating experiences twice

A student may appeal actions concerning dismissal by petitioning the School unit in which they are enrolled.