Aerospace Engineering, Ph.D.

Curriculum in Doctor of Philosophy – Aerospace Engineering

A candidate for the Ph.D. degree with a major in aerospace engineering must comply with the rules and regulations as outlined in the WVU Graduate Catalog and the specific requirements of the Statler College and the Mechanical and Aerospace Engineering Department.

Program Requirements

The doctor of philosophy degree with a major in aerospace engineering is administered through the college’s interdisciplinary Ph.D. program. The research work for the doctoral dissertation must show a high degree of originality on the part of the student and must constitute an original contribution to the art and science of aerospace engineering.

All Ph.D. degree candidates are required to perform research and follow a planned program of study. The student’s research advisor, in conjunction with the student’s Advising and Examining Committee (AEC) will be responsible for determining the plan of study appropriate to the student’s needs. The underlying principle of the planned program is to provide the students with the necessary support to complete their degree and prepare them for their career.

The doctoral courses of study are selected to fit the particular interests and objectives of the student, with proper attention given to broadening related areas of study. The research work for the doctoral dissertation may entail a fundamental investigation into a specialized area or a broad and comprehensive study in a related subject.

All students pursuing a Ph.D. degree in the MAE department are expected to engage in research and complete and successfully defend a Ph.D. dissertation. They should identify a subject for their Ph.D. dissertation, form a five-member advisory and examining committee, and file a plan of study by the end of their first semester of enrollment in the graduate program. At least one member of the graduate faculty from outside the department is required to serve on the advisory and examining committee.

PUBLICATION REQUIREMENT

Prior to scheduling the dissertation defense, Ph.D. students are required to provide written documentation that they have received formal proof of submission of either:

a.) At least one manuscript, generally co-authored with their research supervisor and about some portion of their PhD dissertation research, to an archival journal for publication, or

b.) At least one patent disclosure, also generally about some portion of their PhD dissertation research.

Curriculum Requirements

A minimum cumulative GPA of 3.0 is required in all courses.

Course Requirements

Core Area Courses

<table>
<thead>
<tr>
<th>Area</th>
<th>Course Code</th>
<th>Course Title</th>
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</thead>
<tbody>
<tr>
<td>A</td>
<td>MAE 532</td>
<td>Dynamics of Viscous Fluids</td>
</tr>
<tr>
<td></td>
<td>MAE 624</td>
<td>Convection Heat Transfer</td>
</tr>
<tr>
<td></td>
<td>MAE 636</td>
<td>Fundamentals of Turbulent Flow</td>
</tr>
<tr>
<td>B</td>
<td>MAE 521</td>
<td>Advanced Thermodynamics 1</td>
</tr>
<tr>
<td></td>
<td>MAE 532</td>
<td>Dynamics of Viscous Fluids</td>
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<tr>
<td></td>
<td>MAE 624</td>
<td>Convection Heat Transfer</td>
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<tr>
<td>C</td>
<td>MAE 642</td>
<td>Intermediate Dynamics</td>
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<tr>
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<td>MAE 653</td>
<td>Advanced Vibrations</td>
</tr>
<tr>
<td></td>
<td>MAE 660</td>
<td>Feedback Control in Mechanical Engineering</td>
</tr>
<tr>
<td>D</td>
<td>MAE 543</td>
<td>Advanced Mechanics of Materials</td>
</tr>
<tr>
<td></td>
<td>MAE 640</td>
<td>Continuum Mechanics</td>
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<tr>
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</tr>
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<td></td>
<td>MAE 653</td>
<td>Advanced Vibrations</td>
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</tbody>
</table>
## Mathematics Requirements

Select two of the following (at least one course with MATH prefix or MAE 515):

- **MATH 521** Numerical Analysis
- **MATH 522** Numerical Solution of PDE
- **MATH 541** Modern Algebra 1
- **MATH 543** Linear Algebra
- **MATH 545** Number Theory 1
- **MATH 551** Real Variables 1
- **MATH 555** Complex Variables 1
- **MATH 560** Introduction to Dynamical Systems and Applications
- **MATH 563** Mathematical Modeling
- **MATH 564** Intermediate Differential Equations
- **MATH 566** Intermediate Partial Differential Equations
- **MATH 567** Advanced Calculus 1
- **MATH 568** Advanced Calculus
- **MATH 573** Graph Theory
- **STAT 513** Design of Experiments
- **STAT 545** Applied Regression Analysis
- **STAT 561** Theory of Statistics 1
- **STAT 562** Theory of Statistics 2
- **MAE 515** Analytical Methods in Engineering
- **MAE 623** Conduction Heat Transfer
- **MAE 633** Computational Fluid Dynamics
- **MAE 640** Continuum Mechanics
- **MAE 645** Energy Methods in Applied Mechanics
- **CHE 531** Mathematical Methods in Chemical Engineering
- **EE 515** Linear Control Systems
- **EE 517** Optimal Control
- **IENG 518** Technology Forecasting
- **IENG 553** Applied Linear Programming
- **PHYS 611** Introduction to Mathematical Physics

## Milestones

- **Plan of Study**
- **Qualifying Exam (Ph.D. qualifying examination)**
- **Candidacy Exam (Dissertation research proposal defense)**
- **Publication Requirement**
- **Final Exam (Final dissertation defense)**
- **Dissertation**

## Total Hours

- **42**

*Students who do not hold a baccalaureate degree in aerospace engineering are required to take a set of undergraduate aerospace courses above and beyond the minimum coursework requirements.

For these students, a minimum of fifty-four hours of coursework and thirty hours of independent research beyond a bachelor’s degree, or eighteen hours of coursework and twenty-four hours of independent research beyond an M.S. degree are required.*
PhD students who also earn their MS degree in the MAE Department are expected to select the third core course in their technical area.

**First Year**

<table>
<thead>
<tr>
<th>Course</th>
<th>Fall Hours</th>
<th>Spring Hours</th>
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<tbody>
<tr>
<td>Core Area Course</td>
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<td>3</td>
</tr>
<tr>
<td>Math Course</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>MAE 797</td>
<td>3</td>
<td>3</td>
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<tr>
<td><strong>Total</strong></td>
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**Second Year**

<table>
<thead>
<tr>
<th>Course</th>
<th>Fall Hours</th>
<th>Spring Hours</th>
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</thead>
<tbody>
<tr>
<td>Additional Course</td>
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<td>3</td>
</tr>
<tr>
<td>MAE 797</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>9</strong></td>
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**Third Year**

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</thead>
<tbody>
<tr>
<td>MAE 797</td>
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<td>9</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>9</strong></td>
<td><strong>9</strong></td>
</tr>
</tbody>
</table>

Total credit hours: 54

**JOURNAL PAPER PUBLICATION REQUIREMENT FOR ALL PHD STUDENTS:**

Beginning with all PhD students admitted for the summer or fall of 2016 and thereafter, every Ph.D. student, prior to his/her dissertation defense, will be required to provide written documentation that they have received formal proof of submission of either:

a.) At least one manuscript, generally co-authored with their research supervisor and about some portion of their PhD dissertation research, to an archival journal for publication, or

b.) At least one patent disclosure, also generally about some portion of their PhD dissertation research.

This publication requirement will have to be satisfied prior to scheduling the defense of the Ph.D. Dissertation.

**Major Learning Outcomes**

**AEROSPACE ENGINEERING**

The MAE Department is committed to deliver high quality education and research experience to all graduate students in order to enable them to achieve success in their careers, though the following Learning Goals:

- Expertise, depth and breadth in a chosen field of aerospace engineering.
- Capacity to engage in original research, advanced technological discovery and innovation in order to advance the frontiers of knowledge in the science of the aerospace engineering discipline.
- Capacity of effective high level communication in order to document, disseminate and transfer knowledge of the science of the aerospace engineering discipline in educational, research or applied workplace settings.
- Appreciation and understanding of the role of the science of the aerospace engineering discipline in a global and societal context.