Curriculum in Master of Science in Aerospace Engineering

A candidate for the M.S. degree 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

All M.S. degree candidates are required to perform research (except those pursuing the coursework-only degree option) 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.

Curriculum Requirements

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

A minimum of 60% of courses must be from 500 level or above.

Course Requirements *

**Thesis Option (30 credit hours)**

<table>
<thead>
<tr>
<th>Technical Electives (6 credit hours)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mathematics Requirements (6 credit hours)</td>
</tr>
<tr>
<td>Additional Courses (12 credit hours) - Any BIOM, CE, CHEM, CPE, CS, EE, IENG, MAE, MATH, MINE, PNGE, PHYS, SENG, or STAT courses 400-799, as approved by the student’s AEC</td>
</tr>
<tr>
<td>MAE 697 Research (6 credit hours)</td>
</tr>
<tr>
<td>Thesis</td>
</tr>
<tr>
<td>Final Oral or Written Examination</td>
</tr>
</tbody>
</table>

**Problem Report Option (33 credit hours)**

<table>
<thead>
<tr>
<th>Technical Electives (6 credit hours)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mathematics Requirements (6 credit hours)</td>
</tr>
<tr>
<td>Additional Courses (18 credit hours) - Any BIOM, CE, CHEM, CPE, CS, EE, IENG, MAE, MATH, MINE, PNGE, PHYS, SENG, or STAT courses 400-799, as approved by the student’s AEC</td>
</tr>
<tr>
<td>MAE 697 Research (3 credit hours)</td>
</tr>
<tr>
<td>Formal Written Report or Professional Report/Paper</td>
</tr>
<tr>
<td>Final Oral or Written Examination</td>
</tr>
</tbody>
</table>

**Coursework Option (33 credit hours)**

<table>
<thead>
<tr>
<th>Technical Electives (18 credit hours)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mathematics Requirements (6 credit hours)</td>
</tr>
<tr>
<td>Additional Courses (9 credit hours) - Any BIOM, CE, CHEM, CPE, CS, EE, IENG, MAE, MATH, MINE, PNGE, PHYS, SENG, or STAT courses 400-799, as approved by the student’s AEC</td>
</tr>
<tr>
<td>Comprehensive Exam (Written or Oral)</td>
</tr>
</tbody>
</table>

Total Hours 30-33

**MATHEMATICS REQUIREMENTS FOR ALL OPTIONS (6 CREDIT HOURS)**

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

<table>
<thead>
<tr>
<th>MATH 420</th>
<th>Numerical Analysis 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 441</td>
<td>Applied Linear Algebra</td>
</tr>
<tr>
<td>MATH 456</td>
<td>Complex Variables</td>
</tr>
<tr>
<td>MATH 521</td>
<td>Numerical Analysis</td>
</tr>
<tr>
<td>MATH 522</td>
<td>Numerical Solution of PDE</td>
</tr>
<tr>
<td>MATH 541</td>
<td>Modern Algebra</td>
</tr>
<tr>
<td>MATH 543</td>
<td>Linear Algebra</td>
</tr>
<tr>
<td>MATH 545</td>
<td>Number Theory 1</td>
</tr>
<tr>
<td>MATH 551</td>
<td>Real Variables 1</td>
</tr>
<tr>
<td>MATH 555</td>
<td>Complex Variables 1</td>
</tr>
<tr>
<td>Course Code</td>
<td>Course Title</td>
</tr>
<tr>
<td>------------</td>
<td>--------------------------------------------------</td>
</tr>
<tr>
<td>MATH 560</td>
<td>Introduction to Dynamical Systems and Applications</td>
</tr>
<tr>
<td>MATH 563</td>
<td>Mathematics Modeling</td>
</tr>
<tr>
<td>MATH 564</td>
<td>Intermediate Differential Equations</td>
</tr>
<tr>
<td>MATH 567</td>
<td>Advanced Calculus</td>
</tr>
<tr>
<td>MATH 568</td>
<td>Advanced Calculus</td>
</tr>
<tr>
<td>MATH 573</td>
<td>Graph Theory</td>
</tr>
<tr>
<td>STAT 513</td>
<td>Design of Experiments</td>
</tr>
<tr>
<td>STAT 545</td>
<td>Applied Regression Analysis</td>
</tr>
<tr>
<td>STAT 561</td>
<td>Theory of Statistics 1</td>
</tr>
<tr>
<td>STAT 562</td>
<td>Theory of Statistics 2</td>
</tr>
<tr>
<td>MAE 515</td>
<td>Analytical Methods in Engineering</td>
</tr>
<tr>
<td>MAE 623</td>
<td>Conduction Heat Transfer</td>
</tr>
<tr>
<td>MAE 633</td>
<td>Computational Fluid Dynamics</td>
</tr>
<tr>
<td>MAE 640</td>
<td>Continuum Mechanics</td>
</tr>
<tr>
<td>MAE 645</td>
<td>Energy Methods in Applied Mechanics</td>
</tr>
<tr>
<td>CHE 531</td>
<td>Mathematical Methods in Chemical Engineering</td>
</tr>
<tr>
<td>EE 463</td>
<td>Digital Signal Processing Fundamentals</td>
</tr>
<tr>
<td>EE 465</td>
<td>Introduction to Digital Image Processing</td>
</tr>
<tr>
<td>EE 515</td>
<td>Linear Control Systems</td>
</tr>
<tr>
<td>EE 517</td>
<td>Optimal Control</td>
</tr>
<tr>
<td>IENG 518</td>
<td>Technology Forecasting</td>
</tr>
<tr>
<td>IENG 553</td>
<td>Applied Linear Programming</td>
</tr>
<tr>
<td>PHYS 461</td>
<td>Thermodynamics and Statistical Mechanics</td>
</tr>
</tbody>
</table>

**TECHNICAL AREA COURSES FOR THESIS OR PROBLEM REPORT OPTIONS (6 CREDIT HOURS)**

Select two courses in a single core technical area from the following:

**Area A: Fluid Mechanics and Aerodynamics (FMA)**
- MAE 532  Dynamics of Viscous Fluids
- MAE 624  Convection Heat Transfer
  - or MAE 636  Fundamentals of Turbulent Flow

**Area B: Thermal Sciences and Systems (TSS)**
- MAE 521  Advanced Thermodynamics 1
- MAE 532  Dynamics of Viscous Fluids
- MAE 624  Convection Heat Transfer

**Area C: Dynamics and Controls (D&C)**
- MAE 642  Intermediate Dynamics
  - or MAE 653  Advanced Vibrations
- MAE 660  Feedback Control in Mechanical Engineering

**Area D: Solid Mechanics and Design (SMD)**
- MAE 543  Advanced Mechanics of Materials
  - or MAE 642  Intermediate Dynamics
- MAE 640  Continuum Mechanics
  - or MAE 653  Advanced Vibrations

**Area E: Materials Science (MS)**
- MAE 580  Crystallography and Crystals
- MAE 583  Thermodynamics and Kinetics of Materials
- MAE 649  Microscopy of Materials
TECHNICAL AREA COURSES FOR COURSEWORK OPTION (18 CREDIT HOURS)

Required Courses

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAE 521</td>
<td>Advanced Thermodynamics 1</td>
</tr>
<tr>
<td>MAE 532</td>
<td>Dynamics of Viscous Fluids</td>
</tr>
<tr>
<td>MAE 543</td>
<td>Advanced Mechanics of Materials</td>
</tr>
<tr>
<td>MAE 580</td>
<td>Crystallography and Crystals</td>
</tr>
<tr>
<td>MAE 653</td>
<td>Advanced Vibrations</td>
</tr>
<tr>
<td>MAE 660</td>
<td>Feedback Control in Mechanical Engineering</td>
</tr>
</tbody>
</table>

* Students who do not hold a baccalaureate degree in aerospace engineering will be required to take a set of undergraduate aerospace engineering courses above and beyond the minimum coursework requirements in order to overcome deficiencies in the aerospace engineering area.

Final Examination

M.S. students following the thesis or problem report option must prepare a written research proposal. The proposal must be approved by the student’s AEC at least one semester prior to the final oral examination.

All students, regardless of option, are required to pass a final oral or written examination, administered by their AEC, covering the thesis or problem report and/or related course material.

The students request for the comprehensive exam for students in the Coursework Only degree option must be filed at least four weeks in advance of the desired date of the exam. The comprehensive exam for students in the Coursework Only degree option must be passed at least 3 weeks before graduation.

Suggested Plan of Study

The plan below illustrates the Thesis Option. It is important for students to take courses in the order specified as much as possible; all prerequisites and concurrent requirements must be observed. A typical M.S.A.E degree program that completes degree requirements in two years is as follows.

First Year

<table>
<thead>
<tr>
<th>Fall</th>
<th>Hours</th>
<th>Spring</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technical Area Course</td>
<td>3</td>
<td>Technical Area Course</td>
<td>3</td>
</tr>
<tr>
<td>Math Course</td>
<td>3</td>
<td>Math Course</td>
<td>3</td>
</tr>
<tr>
<td>Additional Course</td>
<td>3</td>
<td>Additional Course</td>
<td>3</td>
</tr>
</tbody>
</table>

9 9

Second Year

<table>
<thead>
<tr>
<th>Fall</th>
<th>Hours</th>
<th>Spring</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Additional Course</td>
<td>3</td>
<td>Additional Course</td>
<td>3</td>
</tr>
<tr>
<td>MAE 697</td>
<td>3</td>
<td>MAE 697</td>
<td>3</td>
</tr>
</tbody>
</table>

6 6

Total credit hours: 30

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.