The astronautics option in engineering mechanics prepares students for design, development, and research, with an emphasis on applied mathematics and astronautics. Its purpose is to improve and expand the educational opportunities of students at the university who wish to pursue careers in astronautics and space-related areas. This is accomplished by providing in depth exposure to course sequences in astrodynamics, orbital mechanics, and flight dynamics, as well as a core curriculum of structural and material analysis, advanced dynamics, and vibrations. The program requires a minimum of 128 credits; students selecting this option must submit an option declaration form to the department office.

**REQUIREMENTS**

The following curriculum applies to students who entered the College of Engineering after fall 2018.

### SUMMARY OF REQUIREMENTS

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td></td>
<td>Mathematics and Statistics</td>
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<td>Science</td>
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<tr>
<td></td>
<td>Engineering Science</td>
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<td></td>
<td>Engineering Mechanics/Astronautics Core</td>
<td>40</td>
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<tr>
<td></td>
<td>Technical Electives</td>
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<td></td>
<td>Communication Skills</td>
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<td>Liberal Studies</td>
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<td><strong>Total Credits</strong></td>
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**MATHEMATICS AND STATISTICS**

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<tbody>
<tr>
<td>MATH 221</td>
<td>Calculus and Analytic Geometry I</td>
<td>5</td>
</tr>
<tr>
<td>or MATH 217</td>
<td>Calculus with Algebra and Trigonometry II</td>
<td>5</td>
</tr>
<tr>
<td>or MATH 275</td>
<td>Topics in Calculus I</td>
<td>5</td>
</tr>
<tr>
<td>MATH 222</td>
<td>Calculus and Analytic Geometry 2</td>
<td>4</td>
</tr>
<tr>
<td>or MATH 276</td>
<td>Topics in Calculus II</td>
<td>4</td>
</tr>
<tr>
<td>MATH 234</td>
<td>Calculus--Functions of Several Variables</td>
<td>4</td>
</tr>
<tr>
<td>MATH 320</td>
<td>Linear Algebra and Differential Equations</td>
<td>3</td>
</tr>
<tr>
<td>MATH 321</td>
<td>Applied Mathematical Analysis</td>
<td>3</td>
</tr>
<tr>
<td>STAT 324</td>
<td>Introductory Applied Statistics for Engineers</td>
<td>3</td>
</tr>
<tr>
<td>or STAT 311</td>
<td>Introduction to Theory and Methods of Mathematical Statistics I</td>
<td>3</td>
</tr>
<tr>
<td>or STAT/MATH 431</td>
<td>Introduction to the Theory of Probability</td>
<td>3</td>
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<td><strong>Total Credits</strong></td>
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**SCIENCE**

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<thead>
<tr>
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<tbody>
<tr>
<td>CHEM 109</td>
<td>Advanced General Chemistry</td>
<td>5</td>
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<tr>
<td>CHEM 103 &amp; CHEM 104</td>
<td>General Chemistry I and II</td>
<td>5</td>
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<td>PHYSICS 202</td>
<td>General Physics</td>
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**ENGINEERING SCIENCE**

<table>
<thead>
<tr>
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<th>Title</th>
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<tbody>
<tr>
<td>INTEREGR 170</td>
<td>Design Practicum</td>
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<tr>
<td>M E 231</td>
<td>Engineering Problem Solving I</td>
<td>3</td>
</tr>
<tr>
<td>or COMP SCI 310</td>
<td>Problem Solving Using Computers</td>
<td>3</td>
</tr>
<tr>
<td>M E 361</td>
<td>Thermodynamics</td>
<td>3</td>
</tr>
<tr>
<td>M E 363</td>
<td>Fluid Dynamics</td>
<td>3</td>
</tr>
<tr>
<td>E C E 376</td>
<td>Electrical and Electronic Circuits</td>
<td>3</td>
</tr>
<tr>
<td>M E 364</td>
<td>Elementary Heat Transfer</td>
<td>3</td>
</tr>
<tr>
<td>E C E 332</td>
<td>Introduction to Feedback Control for Mechanical Engineers</td>
<td>3</td>
</tr>
<tr>
<td>or M E 346</td>
<td>Feedback Control Systems</td>
<td>3</td>
</tr>
<tr>
<td>or M E 446</td>
<td>Automatic Controls</td>
<td>3</td>
</tr>
<tr>
<td>COMP SCI 300</td>
<td>Programming II</td>
<td>3</td>
</tr>
<tr>
<td>COMP SCI 412</td>
<td>Introduction to Numerical Methods</td>
<td>3</td>
</tr>
<tr>
<td>E M A/E P 471</td>
<td>Intermediate Problem Solving for Engineers</td>
<td>3</td>
</tr>
<tr>
<td>E M A/E P 476</td>
<td>Introduction to Scientific Computing for Engineering Physics</td>
<td>3</td>
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<tr>
<td><strong>Total Credits</strong></td>
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**ENGINEERING MECHANICS/ASTRONAUTICS CORE**

<table>
<thead>
<tr>
<th>Code</th>
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<tbody>
<tr>
<td>E M A 201</td>
<td>Statics</td>
<td>3</td>
</tr>
<tr>
<td>E M A 202</td>
<td>Dynamics</td>
<td>3</td>
</tr>
<tr>
<td>E M A 303</td>
<td>Mechanics of Materials</td>
<td>3</td>
</tr>
<tr>
<td>E M A/M E 307</td>
<td>Mechanics of Materials Lab</td>
<td>3</td>
</tr>
<tr>
<td>E M A 405</td>
<td>Practicum in Finite Elements</td>
<td>3</td>
</tr>
<tr>
<td>E M A 469</td>
<td>Design Problems in Engineering</td>
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</tr>
<tr>
<td>E M A 506</td>
<td>Advanced Mechanics of Materials I</td>
<td>3</td>
</tr>
<tr>
<td><strong>Experimental Mechanics Elective (select one)</strong></td>
<td><strong>3</strong></td>
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<tr>
<td>E M A/M E 540</td>
<td>Experimental Vibration and Dynamic System Analysis</td>
<td>3</td>
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<tr>
<td>E M A/M E 570</td>
<td>Experimental Mechanics</td>
<td>3</td>
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<tr>
<td>E M A 611</td>
<td>Advanced Mechanical Testing of Materials</td>
<td>3</td>
</tr>
<tr>
<td>E M A 522</td>
<td>Aerodynamics Lab</td>
<td>3</td>
</tr>
<tr>
<td>E M A 521</td>
<td>Aerodynamics</td>
<td>3</td>
</tr>
<tr>
<td>E M A 542</td>
<td>Advanced Dynamics</td>
<td>3</td>
</tr>
<tr>
<td>E M A 545</td>
<td>Mechanical Vibrations</td>
<td>3</td>
</tr>
<tr>
<td>E M A 569</td>
<td>Senior Design Project</td>
<td>3</td>
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</tbody>
</table>
Spacecraft & Structural Dynamics Elective (select one)
- E M A/ASTRON 550 Astrodynamics
- E M A 610 Structural Finite Element Model Validation
- E M A 642 Satellite Dynamics

Aerospace Fluid Mechanics Elective (select one)
- E M A 523 Flight Dynamics and Control
- E M A 601 Special Topics in Engineering Mechanics (Topic: Rocket Propulsion)

Total Credits 40

**TECHNICAL ELECTIVES**

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
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<tbody>
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</table>

Select five credits at an academic level that requires 2 semesters of calculus or 2 semesters of physics as a pre-requisite. E M A 1 may also be used to satisfy this requirement.

**COMMUNICATION SKILLS**

<table>
<thead>
<tr>
<th>Code</th>
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<th>Credits</th>
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<tbody>
<tr>
<td>ENGL 100</td>
<td>Introduction to College Composition</td>
<td>3</td>
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<tr>
<td>or COM ARTS 100</td>
<td>Introduction to Speech Composition</td>
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<tr>
<td>or LSC 100</td>
<td>Science and Storytelling</td>
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</tr>
<tr>
<td>or ESL 118</td>
<td>Academic Writing II</td>
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<tr>
<td>E P D 275</td>
<td>Technical Presentations</td>
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<td>E P D 397</td>
<td>Technical Communication</td>
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Total Credits 8

**LIBERAL STUDIES**

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
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<tbody>
<tr>
<td></td>
<td>College of Engineering Liberal Studies Requirements</td>
<td></td>
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</tbody>
</table>

Complete Requirements [Link](http://guide.wisc.edu/undergraduate/engineering/#requirementstext) 1

Total Credits 16

1 Students must take 16 credits that carry H, S, L, or Z breadth designators. These credits must fulfill the following subrequirements:

1. A minimum of two courses from the same department or program. At least one of these two courses must be designated as above the elementary level (I, A, or D) in the course listing.

2. A minimum of 6 credits designated as humanities (H, L, or Z in the course listing), and an additional minimum of 3 credits designated as social science (S or Z in the course listing). Foreign language courses count as H credits. Retroactive credits for language courses may not be used to meet the Liberal Studies credit requirement (they can be used for subrequirement 1 above).

3. At least 3 credits in courses designated as ethnic studies (lower case "e" in the course listing). These courses may help satisfy subrequirements 1 and 2 above, but they count only once toward the total required. Note: Some courses may have "e" designation but not H, S, L, or Z designation; these courses do not count toward the Liberal Studies requirement.

For information on credit load, adding or dropping courses, course substitutions, pass/fail, auditing courses, dean’s honor list, repeating courses, probation, and graduation, see the College of Engineering Official Regulations [Link](http://guide.wisc.edu/undergraduate/engineering/#policiesandregulationstext).

**FOUR-YEAR PLAN**

**SAMPLE FOUR-YEAR PLAN**

**First Year**

<table>
<thead>
<tr>
<th>Fall Credits</th>
<th>Spring Credits</th>
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<tbody>
<tr>
<td>CHEM 109</td>
<td>5 E M A 201</td>
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<tr>
<td>MATH 221</td>
<td>5 MATH 222</td>
</tr>
<tr>
<td>Communication A</td>
<td>3 M E 231</td>
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<tr>
<td>INTEREGR 170</td>
<td>3 STAT 324</td>
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<table>
<thead>
<tr>
<th>Liberal Studies Elective</th>
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| Total Credits | 16 |

**Second Year**

<table>
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<tr>
<th>Fall Credits</th>
<th>Spring Credits</th>
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<tbody>
<tr>
<td>MATH 234</td>
<td>4 MATH 320</td>
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<tr>
<td>PHYSICS 202</td>
<td>5 Technical Elective 2</td>
</tr>
<tr>
<td>E M A 202</td>
<td>3 M E 361</td>
</tr>
<tr>
<td>E P 271 or COMP SCI 310</td>
<td>3 E M A 303 4</td>
</tr>
<tr>
<td>E P D 275 or COM ARTS 105</td>
<td>2 E M A/M E 307 1</td>
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</table>

<table>
<thead>
<tr>
<th>Liberal Studies Elective</th>
<th>3</th>
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</table>

| Total Credits | 16 |

**Third Year**

<table>
<thead>
<tr>
<th>Fall Credits</th>
<th>Spring Credits</th>
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<tbody>
<tr>
<td>E M A 506</td>
<td>3 E M A 405</td>
</tr>
<tr>
<td>E M A 542 or 545</td>
<td>3 Experimental Mechanics Course 6</td>
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<tr>
<td>MATH 321</td>
<td>3 M E 363 or CIV ENGR 310</td>
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<td>M S &amp; E 350</td>
<td>3 Computing Elective 3</td>
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<td>E P D 397</td>
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| Liberal Studies Elective | 3 |

| Total Credits | 18 |

**Fourth Year**

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<tr>
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<td>E M A 521</td>
<td>3 EMA Elective</td>
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<tr>
<td>EMA Elective</td>
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<tr>
<td>E C E 376 or PHYSICS 321</td>
<td>3-4 M E 364 3</td>
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| Liberal Studies Elective | 4 Liberal Studies Elective 3 |

| Total Credits 128-129 |

1 Students who were not able to take INTEREGR 170 Design Practicum as freshmen may, with the approval of their advisor,

2 It is recommended that students take CHEM 109 Advanced General Chemistry for 5 credits. However, depending on their high school chemistry experience, students may substitute this with CHEM 103 General Chemistry I and CHEM 104 General Chemistry II for a total of 9 credits.
substitute a course offered in the College of Engineering or in the departments of Chemistry, Computer Sciences, Mathematics, and Physics.

3 Students may substitute PHYSICS 201 General Physics, 5 credits, for E M A 201 Statics, 3 credits, with the approval of their advisor.


5 Students electing E M A 545 Mechanical Vibrations instead of E M A 542 Advanced Dynamics should note that E M A 545 Mechanical Vibrations is offered in the spring semester only.

6 E M A 611 Advanced Mechanical Testing of Materials or E M A/ M E 540 Experimental Vibration and Dynamic System Analysis or E M A/M E 570 Experimental Mechanics or E M A 522 Aerodynamics Lab. Note that EMA/ME 540 and EMA/ME 570 and are typically offered in the fall. EMA 611 and EMA 522 are typically offered in the spring.

7 M E 563 Intermediate Fluid Dynamics may be substituted for E M A 521 Aerodynamics.