# Fall Semester Freshman 2018 Credits
- **CHEM 1035** General Chemistry 3
- **CHEM 1045** General Chemistry Lab (Co: CHEM 1035) 1
- **ENGL 1105** First-Year Writing 3
- **MATH 1225** Calculus of a Single Variable (C) Pre: Math Ready 4
- **ENGE 1215** Foundations of Engineering (C) 2
- Pathways Humanities, Social Sciences, or Equity and Identity 3

**TOTAL Credits**: 16

# Spring Semester Freshman 2019 Credits
- **ENGL 1106** First-Year Writing (Pre: ENGL 1105) 3
- **MATH 1226** Calculus of a Single Variable (C) Pre: MATH 1225 (C) 4
- **MATH 2114** Introduction to Linear Algebra (Pre: MATH 1225 (B) or MATH 1226) 3
- **PHYS 2305** Found of Physics I w/lab (Pre: MATH 1225; Co: MATH 1226) 4
- **ENGE 1216** Foundations of Engineering (C-): Pre: ENGE 1115 (C) or ENGE 1024 (C) 2

**TOTAL Credits**: 16

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# Fall Semester Sophomore 2019 Credits
- **BIOL 1105** Principles of Biology (Co: BIOL 1115) 3
- **MATH 2204** Intro Multivariable Calculus (Pre: MATH 1226) 3
- **MATH 2214** Differential Equations (Pre: MATH 1226, MATH 1114 or 2114) 3
- **ESM 2104** Statics (Pre: MATH 1114 or MATH 2224 or MATH 2224H or MATH 2204 or MATH 2204H) 3
- **PHYS 2306** Foundations of Physics I w/lab (Pre: MATH 1226, PHYS 2305) 4

**TOTAL Credits**: 16

# Spring Semester Sophomore 2020 Credits
- **BMES 2104** Introduction to Biomedical Engineering (Pre: ENGE 1104 or ENGE 1114 or ENGE 1216, PHYS 2306) 3
- **ECE 3054** Electrical Theory (Pre: PHYS 2306; Co: MATH 2214) 3
- **ESM 2204** Mech of Deformable Bodies (Pre: ESM 2104 or 2114, (MATH 2224 or MATH 2224H or MATH 2224 or MATH 2204 or MATH 2204H) 3
- **ESM 2304** Dynamics (Pre: ESM 2104 or 2114, (MATH 2224 or MATH 2224H or MATH 2224 or MATH 2204 or MATH 2204H) 3
- **MSE 2034** Elements of Materials Eng (Pre: CHEM 1035; Co: PHYS 2305) 3

**TOTAL Credits**: 15

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# Fall Semester Junior 2020 Credits
- **BMES 3024** BME Cellular Lab and Design (Pre: BMES 2104) 2
- **ESM 3234** Fluid Mechanics (Pre: ESM 2304, PHYS 2306) 3
- **CS Programming Course** 3
- **STAT Course** 3
- **BMES/BMIS 4064** Introduction to Medical Physiology (Pre: Junior Standing) 3

**TOTAL Credits**: 14

# Spring Semester Junior 2021 Credits
- **BMES 3034** Bioinstrumentation Laboratory & Design for Living Systems (Pre: BMES 2104) 2
- **BMES 3184** Problem Solving in BME (Pre: BMES 2104) 3
- **BMES Technical Elective** 3
- **Technical Elective** 3
- **Pathways Humanities, Social Sciences, or Equity and Identity** 3

**TOTAL Credits**: 14

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# Fall Semester Senior 2021 Credits
- **BMES 4015** BME Senior Design and Project 3
- **BMES 4134** Global, Societal and Ethics in BME 3
- **BMES Technical Elective** 3
- **Technical Elective** 3
- **Pathways Humanities, Social Sciences, or Equity and Identity** 3
- **Pathways Arts** 2

**TOTAL Credits**: 17

# Spring Semester Senior 2022 Credits
- **BMES 4016** BME Senior Design and Project (Pre: BMES 4015) 3
- **BMES Technical Elective** 3
- **BMES Technical Elective** 3
- **Technical Elective** 3
- **Pathways Humanities, Social Sciences, or Equity and Identity** 3

**TOTAL Credits**: 15

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1 A total of 6 hours of Reasoning in the Social Sciences and 6 hours of Critical Thinking in the Humanities must be completed. Three hours of Critical Analysis of Equity and Identity in the United States is also required and may be double-counted with another area of Pathways. Use extra care when selecting this course.

2 CS Programming course chosen from: CS 1044, 1064, or 1114

3 STAT course chosen from: STAT 3615, STAT 4604

4 Pathways Requirement

5 BME Degree Core Requirement
Superscripted annotation (F, S, SI, SII) in credits column indicates terms when a course is expected to be offered.

<table>
<thead>
<tr>
<th>Pathways for General Education (Pathways)</th>
<th>ENGL 1105 (Foundational)</th>
<th>(3) ENGL 1106 (Foundational)</th>
<th>(3) BMES 4016 (Advanced)</th>
<th>(3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Discourse (6 foundational + 3 advanced)</td>
<td>MATH 1225 (Foundational)</td>
<td>(4) MATH 1226 (Foundational)</td>
<td>(4) MATH 2214 (Advanced)</td>
<td>(3)</td>
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<tr>
<td>Quantitative and Computational Thinking (6 foundational + 3 advanced)</td>
<td>PHYS 2305 (4)</td>
<td>PHYS 2306 (4)</td>
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<td>Reasoning in the Natural Sciences (6 hrs)</td>
<td>ENGE 1215+ENGE 1216 (4)</td>
<td>(Arts)</td>
<td>(2)</td>
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<tr>
<td>Critique and Practice in Design and the Arts (6 hrs)</td>
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<tr>
<td>Reasoning in the Social Sciences (6 hrs)</td>
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<tr>
<td>Critical Thinking in the Humanities (6 hrs)</td>
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<tr>
<td>Critical Analysis of Equity and Identity in the United States (3 hrs)</td>
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</tr>
</tbody>
</table>

1A total of 6 hours of Reasoning in the Social Sciences and 6 hours of Critical Thinking in the Humanities courses must be completed. Three hours of Critical Analysis of Equity and Identity in the United States is also required and may be double-counted with another area of Pathways. Use extra care when selecting this course.

Electives:
Biomedical Engineering (BMES) Technical Electives (12 credit hours required)
Any 3-credit BMES 3/4/5000-level course not otherwise used to fulfill a BME requirement can be used as a technical elective. BMES Technical Electives may be chosen from the approved list on page 4 of the checklist.

Technical Electives (9 credit hours required)
An approved 2/3/4000-level course in another discipline that has significant technical content relevant to the science or application of biomedical engineering can be used as a technical elective. Technical Electives may be chosen from the list on page 3 of the checklist.

Change of Major Requirements: For Change of Major requirements, please see:

Foreign Language Requirements: Students must have had 2 years of a foreign language in high school or one year at the college level (6 credit hours) of the same language. College-level credits used to meet this requirement do not count towards the degree.

Satisfactory Progress Towards Degree: University Policy 91 outlines university-wide minimum criteria to determine if students are making satisfactory progress towards the completion of their degrees. The BME Department fully supports this policy. Specific expectations for satisfactory progress for Biomedical Engineering majors are as follows:

- Each student must meet the minimum University-wide criteria as described in Policy 91 and summarized in the Undergraduate Catalog (under Academic Policies)
- After having completed 72 credit hours (including transfer, advanced placement, advanced standing, and credit by examination) must have:
  - Maintain an in-major GPA (in-major GPA is calculated using all courses taught under the BMES designator) and an extended in-major GPA (extended in-major GPA is calculated using all BMES courses and ESM 2104, 2204, and 2304) of 2.0 or better
- Complete a minimum of 12 credits that apply toward the BME degree per academic year (including summer and winter sessions).

Statement of Prerequisites:
- Pre-requisites for each course are listed after the course title. The (letter grade) notation, such as (C-), indicates the minimum grade students must earn in the pre-requisite course. There are no hidden pre-requisites in the program of study. Prerequisites may change from what is indicated. Be sure to consult the University Catalog or check with your advisor for the most current pre-requisites.

Graduation Requirements: Each student must complete at least 123 semester credit hours with a minimum overall GPA of 2.00 and a minimum in-major GPA of 2.00. All BMES prefix courses count towards the in-major GPA.
Approved BMES Technical Electives:

BMES 3124 – Introduction to Biomechanics Pre: BMES 2104, ESM 2204, ESM 2304
BMES 3134 – Introduction to BME Imaging Pre: BMES 2104, (MATH 2204 or 2204H), PHYS 2306
BMES 3144 – Biomedical Devices Pre: BMES 2104
BMES 4154 – Commercialization of BME Research Pre: BMES 2104, 3024

Students in their senior year, with 3.0 or better GPA, may enroll in 5000-level courses satisfying undergraduate degree requirements within their department with the permission of the course instructor and the Department Head.

BMES 5024 (cross-listed with BMVS 5224) – Biomedical Engineering and Human Disease Pre: BMES 5004 or BMES/BMVS 4064
BMES 5044 (cross-listed with BSE 5044 and CHE 5044)– Engineering Mathematics
BMES 5054 – Quantitative Cell Physiology Co: BMES 5044
BMES 5064 – Quantitative Organ Systems Physiology Co: BMES 5044
BMES 5124 (cross-listed with ESM 5224)– Advanced Musculoskeletal Biomechanics
BMES 5154G – Advanced Commercialization of Biomedical Engineering Research
BMES 5164 – Advanced Impact Biomechanics
BMES 5174 (cross-listed with ME 5174) – Biomechanics of Crash Injury Prevention
BMES 5184 – Injury Physiology Pre: BMES 5004, Co: BMES 5164
BMES 5214 (cross-listed with ISE 5614) – Human Physical Capabilities
BMES 5304 – Biological Transport Phenomena
BMES 5304 – Advanced Biological Transport Phenomena Pre: CHE 3114, (CHE 3044 OR CHE 3144) OR (ME 3304 OR ME 3404)
BMES 5305 (cross-listed with ESM 5305) – Biomechanics of Cardiovascular System
BMES 5306 (cross-listed with ESM 5306) – Biomechanics of Cardiovascular System
BMES 5314 – Introduction to Regenerative Medicine
BMES 5434 (cross-listed with CHE 5214) – Polymeric Biomaterials
BMES 5514 (cross-listed with ME 5714) – Digital Signal Processing for Mechanical Measurements
BMES 5574 (cross-listed with ECE 5605) – Stochastic Signals and Systems Pre: STAT 4714
BMES 5714 – Biomedical Microdevices
BMES 5724 – Biomedical Nanoengineering
BMES 5764 – Modeling MEMS and NEMS
### Approved Technical Electives:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>BCHM 3114</td>
<td>Biochemistry for Biotechnology and the Life Sciences</td>
<td>ESM 4245-ESM 4246</td>
<td>Mechanics of Animal Locomotion</td>
</tr>
<tr>
<td>BIOL 2004</td>
<td>Genetics</td>
<td>ESM 4304</td>
<td>Hemodynamics</td>
</tr>
<tr>
<td>BIOL 3134</td>
<td>Human Genetics</td>
<td>HNFE 3634</td>
<td>Epidemiologic Concepts of Health and Disease</td>
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<tr>
<td>BIOL 4704</td>
<td>Immunology</td>
<td>HNFE 3824</td>
<td>Kinesiology</td>
</tr>
<tr>
<td>BIOL 4734</td>
<td>Inflammation Biology</td>
<td>HNFE 4844</td>
<td>Exercise and Neuromuscular Performance</td>
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<tr>
<td>BMVS/BCHM 4034</td>
<td>Environmental Health Toxicology</td>
<td>ISE 3614</td>
<td>Human Factors Engineering and Ergonomics</td>
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<td>BMVS 4054</td>
<td>Laboratory Animal Management</td>
<td>ISE 4624</td>
<td>Work Physiology</td>
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<td>BMVS 4074</td>
<td>Pharmacology</td>
<td>MATH 3214</td>
<td>Calculus of Several Variables</td>
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<td>BSE 3534</td>
<td>Bioprocessing Engineering</td>
<td>MATH 4234</td>
<td>Elementary Complex Analysis</td>
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<td>BES 4544/CHE 4544</td>
<td>Protein Separation Engineering</td>
<td>MATH 4445-MATH 4446</td>
<td>Introduction to Numerical Analysis</td>
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<td>CHE 4104</td>
<td>Processing Materials</td>
<td>ME 4034</td>
<td>Bio-inspired Technology</td>
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<td>CHE 4304 (ME 4344)</td>
<td>Biological Transport Phenomena</td>
<td>ME 4524</td>
<td>Introduction to Robotics and Automation</td>
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<tr>
<td>CHEM 2535-CHEM 2536</td>
<td>Organic Chemistry</td>
<td>ME 4864</td>
<td>Micro/Nano-Robotics</td>
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<td>CHEM 2545-CHEM 2546</td>
<td>Organic Chemistry Laboratory</td>
<td>MSE 4164</td>
<td>Principles of Materials Corrosion</td>
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<td>CHEM 4554</td>
<td>Drug Chemistry</td>
<td>MSE 4304</td>
<td>Metals and Alloys</td>
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<td>CS 3824</td>
<td>Introduction to Computational Biology and Bioinformatics</td>
<td>MSE 4574</td>
<td>Biomaterials</td>
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<td>CS 4884</td>
<td>Computational Biology and Bioinformatics Capstone</td>
<td>MSE 4584</td>
<td>Biomimetic Materials</td>
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<td>ECE 4580</td>
<td>Digital Processing Imaging</td>
<td>MSE 4614</td>
<td>Nanomaterials</td>
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<td>ECE 4624</td>
<td>DSP and Filter Design</td>
<td>NEUR 3044</td>
<td>Cellular and Molecular Neuroscience</td>
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<td>ECE 4405-ECE 4406</td>
<td>Control Systems</td>
<td>PHYS 3324</td>
<td>Modern Physics</td>
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<td>ESM/MSE 3054</td>
<td>Mechanical Behavior of Materials</td>
<td>PHYS 3405-PHYS 3406</td>
<td>Intermediate Electricity and Magnetism</td>
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<td>ESM 4024</td>
<td>Advanced Mechanical Behavior of Materials</td>
<td>PHYS 4455-PHYS 4456</td>
<td>Introduction to Quantum Mechanics</td>
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<td>ESM 4044</td>
<td>Mechanics of Composite Materials</td>
<td>PHYS 4504</td>
<td>Introduction to Nuclear and Particle Physics</td>
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<td>ESM 4105-ESM 4106</td>
<td>Engineering Analysis of Physiologic Systems</td>
<td>PHYS 4574</td>
<td>Nanotechnology</td>
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<td>ESM 4204</td>
<td>Musculoskeletal Biomechanics</td>
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<td>Optics</td>
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<td>ESM 4224</td>
<td>Biodynamics &amp; Control</td>
<td>PHYS 4714</td>
<td>Introduction to Biophysics</td>
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<tr>
<td>ESM 4234</td>
<td>Mechanics of Biological Materials and Structures</td>
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