MINOR IN ENERGY SYSTEMS

The School of Mechanical Engineering now offers a 15-hour multidisciplinary minor in Energy Systems. This minor is available to students majoring in Mechanical Engineering. Requirements include courses which provide depth in an area relevant to energy related to Mechanical Engineering. The minor also includes requirements for courses which cut across disciplines. These courses are intended to add breadth of knowledge in areas outside the student’s major but important to energy systems. A terminal “capstone” or project course provides an opportunity for students from multiple disciplines to work together in multidisciplinary teams on a significant project in the energy area.

Minor Program of Study & Guidelines (http://catalog.gatech.edu/academics/minors)

Program of Study - Track for Aerospace Engineering Students

The minor includes requirements for courses which cut across disciplines. These courses are intended to add breadth of knowledge in areas outside the student’s major but important to energy systems. A terminal “capstone” or project course provides an opportunity for students from multiple disciplines to work together in multidisciplinary teams on a significant project in the energy area.

The breadth courses and the capstone project course, courses taken by all students completing the minor, require one or more prerequisites; specifically, basic economics, mathematics, and lab science courses. The minor must consist of at least 15 credit hours and all courses in the minor also must be 3000 level and above.

A multidisciplinary or other minor may contain courses in a student’s major field of study. A maximum of 6 credit hours of such courses may be used to satisfy the course requirements for the minor, provided these courses are not also used to satisfy any course requirement in the student’s major degree program.

All courses counting toward the minor must be taken on a letter-grade basis and completed with an overall grade-point average of at least 2.00.

All courses in the minor also must be 3000 level and above.

Prerequisite Courses

Students ordinarily pursue the minor upon completion of the needed prerequisites. However, the depth course requirements may be taken as soon as students have met the relevant prerequisites.

The prerequisites needed for one or more of the courses required for the minor (breadth courses and the capstone project course) are (all existing courses):

Mathematics

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 1501</td>
<td>Calculus I</td>
<td>4</td>
</tr>
<tr>
<td>MATH 1502</td>
<td>Calculus II</td>
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</tr>
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<td>MATH 2401</td>
<td>Calculus III</td>
<td>4</td>
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</table>

Physics

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHYS 2211</td>
<td>Introductory Physics I</td>
<td>4</td>
</tr>
<tr>
<td>PHYS 2212</td>
<td>Introductory Physics II</td>
<td>4</td>
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</tbody>
</table>

Chemistry

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 1310</td>
<td>General Chemistry</td>
<td>4</td>
</tr>
<tr>
<td>or CHEM 1210</td>
<td>Chemical Principles I</td>
<td></td>
</tr>
</tbody>
</table>

Economics

Select one of the following: 3-6

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECON 2100</td>
<td>Economic Analysis and Policy Problems</td>
</tr>
<tr>
<td>or ECON 2100</td>
<td>The Global Economy</td>
</tr>
<tr>
<td>ECON 2105</td>
<td>Principles of Macroeconomics</td>
</tr>
<tr>
<td>&amp; ECON 2106</td>
<td>Principles of Microeconomics</td>
</tr>
</tbody>
</table>

Requirements

Depth Courses

Select 6 credit hours related to energy systems: 1 6

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>AE 4701</td>
<td>Wind Engineering</td>
</tr>
<tr>
<td>AE 4370</td>
<td>Life Cycle Cost Analysis</td>
</tr>
<tr>
<td>NRE 3208</td>
<td>Nuclear Reactor Phys I</td>
</tr>
<tr>
<td>NRE 3301</td>
<td>Radiation Physics</td>
</tr>
<tr>
<td>AE 4461</td>
<td>Introduction to Combustion</td>
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</table>

Breadth Courses

Select two of the following: 2 6

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
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</thead>
<tbody>
<tr>
<td>ECON 3300</td>
<td>Economics of International Energy Markets</td>
</tr>
<tr>
<td>PUBP 3350</td>
<td>Energy Policy</td>
</tr>
<tr>
<td>CHEM 3700</td>
<td>The Science of Alternative Energy</td>
</tr>
</tbody>
</table>

Capstone Course

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>GT 4813</td>
<td>Project in Energy Systems 3</td>
</tr>
</tbody>
</table>

Total Credit Hours 15

Notes:

1. The Depth Courses may have additional prerequisites; please check the current prerequisites (http://www.catalog.gatech.edu/academics/courses).
2. A list of acceptable courses which meet the depth requirement is provided by each major approving the minor. Depth courses may be taken in the student’s major to ensure the depth in that major needed to peruse a multidisciplinary minor. All acceptable depth courses must be consistent with the goals of the minor. Examples of acceptable courses include engineering courses covering a specific energy technology like solar or relevant engineering science.
3. Ordinarily, students must complete all minor requirements before they can register for the Project in Energy Systems course.

Program of Study - Track for Chemical and Biomolecular Engineering Students

The minor includes requirements for courses which cut across disciplines. These courses are intended to add breadth of knowledge in areas outside the student’s major but important to energy systems. A terminal “capstone” or project course provides an opportunity for students from multiple disciplines to work together in multidisciplinary teams on a significant project in the energy area.

The breadth courses and the capstone project course, courses taken by all students completing the minor, require one or more prerequisites;
specifically, basic economics, mathematics, and lab science courses. The minor must consist of at least 15 credit hours and all courses in the minor also must be 3000 level and above.

A multidisciplinary or other minor may contain courses in a student's major field of study. A maximum of 6 credit hours of such courses may be used to satisfy the course requirements for the minor, provided these courses are not also used to satisfy any course requirement in the student's major degree program.

All courses counting toward the minor must be taken on a letter-grade basis and completed with a grade of C (2.00) or better.

All courses in the minor also must be 3000 level and above.

**Prerequisite Courses**

Students ordinarily pursue the minor upon completion of the needed prerequisites. However, the depth course requirements may be taken as soon as students have met the relevant prerequisites.

The prerequisites needed for one or more of the courses required for the minor (breadth courses and the capstone project course) are (all existing courses):

**Mathematics**
- MATH 1501 Calculus I 4
- MATH 1502 Calculus II 4
- MATH 2401 Calculus III 4

**Physics**
- PHYS 2211 Introductory Physics I 4
- PHYS 2212 Introductory Physics II 4

**Chemistry**
- CHEM 1310 General Chemistry or CHEM 1211K 4

**Economics**
- Select one of the following: 3-6
  - ECON 2100 Economic Analysis and Policy Problems
  - ECON 2101 Principles of Macroeconomics
  - ECON 2102 Principles of Microeconomics

**Requirements**

**Depth Courses**
Select 6 credit hours related to energy systems: 1
- CHBE 4020 Chemical Engineering in Nanoscale Systems
- CHBE 4310 Bioprocess Engineering
- CHBE 4760 Biocatalysis and Metabolic Engineering
- CHBE 4803 Special Topics (Electrochemical Energy Storage & Conversion)
- CHBE 6130 Electrochemical Engineering

**Breadth Courses**
Select two of the following: 2
- ECON 3300 Economics of International Energy Markets
- PUBP 3350 Energy Policy
- CHEM 3700 The Science of Alternative Energy

**Capstone Course**

**Program of Study - Track for Electrical and Computer Engineering Students**

The minor includes requirements for courses which cut across disciplines. These courses are intended to add breadth of knowledge in areas outside the student's major but important to energy systems. A terminal "capstone" or project course provides an opportunity for students from multiple disciplines to work together in multidisciplinary teams on a significant project in the energy area.

The breadth courses and the capstone project course, courses taken by all students completing the minor, require one or more prerequisites; specifically, basic economics, mathematics, and lab science courses. The minor must consist of at least 15 credit hours and all courses in the minor also must be 3000 level and above.

A multidisciplinary or other minor may contain courses in a student's major field of study. A maximum of 6 credit hours of such courses may be used to satisfy the course requirements for the minor, provided these courses are not also used to satisfy any course requirement in the student's major degree program.

All courses counting toward the minor must be taken on a letter-grade basis and completed with a grade of C (2.00) or better.

All courses in the minor also must be 3000 level and above.

**Prerequisite Courses**

Students ordinarily pursue the minor upon completion of the needed prerequisites. However, the depth course requirements may be taken as soon as students have met the relevant prerequisites.

The prerequisites needed for one or more of the courses required for the minor (breadth courses and the capstone project course) are (all existing courses):

**Mathematics**
- MATH 1501 Calculus I 4
- MATH 1502 Calculus II 4
- MATH 2401 Calculus III 4

**Physics**
- PHYS 2211 Introductory Physics I 4
Minor in Energy Systems

PHYS 2212  Introductory Physics II  4
Chemistry
CHEM 1310  General Chemistry  4
or CHEM 1200  Chemical Principles I
Economics
Select one of the following: 3-6
- ECON 2100 Economic Analysis and Policy Problems
- or ECON The Global Economy
- ECON 2105 Principles of Macroeconomics
& ECON 2106 Principles of Microeconomics

Requirements
Depth Courses
Select 6 credit hours of depth courses related to energy systems: 6
- ECE 3070 Electromechanical and Electromagnetic Energy Conversion
- ECE 3071 Modern Electric Energy Systems
- ECE 4320 Power System Analysis and Control
- ECE 4321 Power System Engineering
- ECE 4325 Electric Power Quality
- ECE 4330 Power Electronics
- ECE 4335 Electric Machinery Analysis
- NRE 3208 Nuclear Reactor Phys I
- NRE 3301 Radiation Physics

Breadth Courses
Select two of the following: 3
- ECON 3300 Economics of International Energy Markets
- PUBP 3350 Energy Policy
- CHEM 3700 The Science of Alternative Energy

Capstone Course
GT 4813  Project in Energy Systems  4

Total Credit Hours  15

The Depth Courses may have additional prerequisites; please check the current prerequisites (http://www.catalog.gatech.edu/academics/courses).
- A list of acceptable courses which meet the depth requirement is provided by each major approving the minor. Depth courses may be taken in the student’s major to ensure the depth in that major needed to peruse a multidisciplinary minor. All acceptable depth courses must be consistent with the goals of the minor. Examples of acceptable courses include engineering courses covering a specific energy technology like solar or relevant engineering science.
- Any course on this list that is taken for ECE elective, engineering elective, or approved elective credit can count for this minor.

If used for EE Breadth credit, ECE 3070 and ECE 3071 cannot be used for this minor.

Students should strive to complete the necessary prerequisites and the depth courses prior to enrolling in the breadth courses. However, depth courses may be taken concurrently with the courses taken to meet the breadth requirement.
- Breadth courses may ordinarily serve as technical or free electives in the student’s program of study. However, courses required by name and number and/or used to satisfy Core Areas A through E cannot be used to satisfy the requirements of a minor.

Ordinarily, students must complete all minor requirements before they can register for the Project in Energy Systems course.

Program of Study - Track for Industrial Systems Engineering Students

The minor includes requirements for courses which cut across disciplines. These courses are intended to add breadth of knowledge in areas outside the student’s major but important to energy systems. A terminal “capstone” or project course provides an opportunity for students from multiple disciplines to work together in multidisciplinary teams on a significant project in the energy area.

The breadth courses and the capstone project course, courses taken by all students completing the minor, require one or more prerequisites; specifically, basic economics, mathematics, and lab science courses. The minor must consist of at least 15 credit hours and all courses in the minor also must be 3000 level and above.

A multidisciplinary or other minor may contain courses in a student’s major field of study. A maximum of 6 credit hours of such courses may be used to satisfy the course requirements for the minor, provided these courses are not also used to satisfy any course requirement in the student’s major degree program.

All courses counting toward the minor must be taken on a letter-grade basis and completed with a grade of C (2.00) or better.

All courses in the minor also must be 3000 level and above.

Prerequisite Courses

Students ordinarily pursue the minor upon completion of the needed prerequisites. However, the depth course requirements may be taken as soon as students have met the relevant prerequisites.

The prerequisites needed for one or more of the courses required for the minor (breadth courses and the capstone project course) are (all existing courses):

Mathematics
- MATH 1501 Calculus I  4
- MATH 1502 Calculus II  4
- MATH 2401 Calculus III  4

Physics
- PHYS 2211 Introductory Physics I  4
- PHYS 2212 Introductory Physics II  4

Chemistry
- CHEM 1310 General Chemistry  4
  or CHEM 1200 Chemical Principles I

Economics
Select one of the following: 3-6
- ECON 2100 Economic Analysis and Policy Problems
  or ECON The Global Economy
- ECON 2105 Principles of Macroeconomics
  & ECON 2106 Principles of Microeconomics

Requirements
Depth Courses
Select 6 credit hours of depth courses related to energy systems: 6
The minor includes requirements for courses which cut across disciplines. These courses are intended to add breadth of knowledge in areas outside the student’s major but important to energy systems. A terminal “capstone” or project course provides an opportunity for students from multiple disciplines to work together in multidisciplinary teams on a significant project in the energy area.

### Program of Study - Track for Mechanical Engineering Students

The minor includes requirements for courses which cut across disciplines. These courses are intended to add breadth of knowledge in areas outside the student’s major but important to energy systems. A terminal “capstone” or project course provides an opportunity for students from multiple disciplines to work together in multidisciplinary teams on a significant project in the energy area.

### Minor in Energy Systems

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
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</thead>
<tbody>
<tr>
<td>AE/ME 4701</td>
<td>Wind Engineering</td>
</tr>
<tr>
<td>ECE 3072</td>
<td>Electrical Energy Systems</td>
</tr>
<tr>
<td>ISYE 4803</td>
<td>Special Topics (Energy and Environment)</td>
</tr>
<tr>
<td>ME 4011</td>
<td>Internal Combustion Engines</td>
</tr>
<tr>
<td>ME 4325</td>
<td>Introduction to Fuel Cell Systems</td>
</tr>
<tr>
<td>ME 4823</td>
<td>Special Topics (Mechatronic systems in Hybrid-electric power trains)</td>
</tr>
<tr>
<td>ME 4171</td>
<td>Environmentally Conscious Design and Manufacturing</td>
</tr>
<tr>
<td>ME 4172</td>
<td>Designing Sustainable Engineering Systems</td>
</tr>
<tr>
<td>ME 4803</td>
<td>Special Topics in Mechanical Engineering (Thermal Systems Engineering)</td>
</tr>
<tr>
<td>NRE 4610</td>
<td>Introduction to Plasma Physics and Fusion Engineering</td>
</tr>
</tbody>
</table>

#### Breadth Courses

Select two of the following:

- CHEM 3700 The Science of Alternative Energy
- EAS 4410 Climate and Global Change
- EAS 3110 Energy, Environment, and Society
- ECON 3300 Economics of International Energy Markets
- PUBP 3315 Environmental Policy and Politics
- PUBP 3350 Energy Policy
- PUBP 3600 Sustainability, Technology, and Policy
- PUBP 4440 Science, Technology, and Regulation
- PHIL 4176 Environmental Ethics
- CHEM 3700 The Science of Alternative Energy

#### Capstone Course

GT 4813 Project in Energy Systems

<table>
<thead>
<tr>
<th>Total Credit Hours</th>
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<tbody>
<tr>
<td>3</td>
</tr>
</tbody>
</table>

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1. The Depth Courses may have additional prerequisites; please check the current prerequisites (http://www.catalog.gatech.edu/academics/courses).
2. Students should strive to complete the necessary prerequisites and the depth courses prior to enrolling in the breadth courses. However, depth courses may be taken concurrently with the courses taken to meet the breadth requirement.
3. Ordinarily, students must complete all minor requirements before they can register for the Project in Energy Systems course.

### Prerequisite Courses

Students ordinarily pursue the minor upon completion of the needed prerequisites. However, the depth course requirements may be taken as soon as students have met the relevant prerequisites.

The prerequisites needed for one or more of the courses required for the minor (breadth courses and the capstone project course) are (all existing courses):

#### Mathematics

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
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</thead>
<tbody>
<tr>
<td>MATH 1501</td>
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</tr>
<tr>
<td>MATH 1502</td>
<td>Calculus II</td>
</tr>
<tr>
<td>MATH 2401</td>
<td>Calculus III</td>
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</table>

#### Physics

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHYS 2211</td>
<td>Introductory Physics I</td>
</tr>
<tr>
<td>PHYS 2212</td>
<td>Introductory Physics II</td>
</tr>
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</table>

#### Chemistry

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 1310</td>
<td>General Chemistry</td>
</tr>
<tr>
<td>or CHEM 1210 Chemical Principles I</td>
<td></td>
</tr>
</tbody>
</table>

#### Economics

Select one of the following:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECON 2100</td>
<td>Economic Analysis and Policy Problems</td>
</tr>
<tr>
<td>or ECON 2105 The Global Economy</td>
<td></td>
</tr>
<tr>
<td>ECON 2105 Principles of Macroeconomics</td>
<td></td>
</tr>
<tr>
<td>&amp; ECON 2106 Principles of Microeconomics</td>
<td></td>
</tr>
</tbody>
</table>

### Requirements

#### Depth Courses

Select 6 credit hours related to energy systems:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>ME 4011</td>
<td>Internal Combustion Engines</td>
</tr>
<tr>
<td>ME 4315</td>
<td>Energy Systems Analysis and Design</td>
</tr>
<tr>
<td>ME 4325</td>
<td>Introduction to Fuel Cell Systems</td>
</tr>
<tr>
<td>ME 4321</td>
<td>Principles of Air Conditioning</td>
</tr>
<tr>
<td>ME 4823</td>
<td>Special Topics (Mechatronic Systems in Hybrid-Electric Powertrains)</td>
</tr>
<tr>
<td>ME 4823</td>
<td>Special Topics (Renewable Energy Systems)</td>
</tr>
<tr>
<td>ME 4171</td>
<td>Environmentally Conscious Design and Manufacturing</td>
</tr>
<tr>
<td>ME 4172</td>
<td>Designing Sustainable Engineering Systems</td>
</tr>
<tr>
<td>ME 4701</td>
<td>Wind Engineering</td>
</tr>
<tr>
<td>ECE 3071</td>
<td>Modern Electric Energy Systems</td>
</tr>
</tbody>
</table>

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The breadth courses and the capstone project course, courses taken by all students completing the minor, require one or more prerequisites; specifically, basic economics, mathematics, and lab science courses. The minor must consist of at least 15 credit hours and all courses in the minor also must be 3000 level and above.

A multidisciplinary or other minor may contain courses in a student’s major field of study. A maximum of 6 credit hours of such courses may be used to satisfy the course requirements for the minor; provided these courses are not also used to satisfy any course requirement in the student’s major degree program.

All courses counting toward the minor must be taken on a letter-grade basis and completed with a grade of C (2.00) or better.

All courses in the minor also must be 3000 level and above.
NRE 3208 Nuclear Reactor Phys I
NRE 4214 Reactor Engineering
NRE 4610 Introduction to Plasma Physics and Fusion Engineering

Breadth Courses
CHEM 3700 The Science of Alternative Energy 3
ECON 3300 Economics of International Energy Markets 3
or PUBP 33 Energy Policy

Capstone Course
GT 4813 Project in Energy Systems 3

Total Credit Hours 15

Prerequisite Courses
Students ordinarily pursue the minor upon completion of the needed prerequisites. However, the depth course requirements may be taken as soon as students have met the relevant prerequisites.

The prerequisites needed for one or more of the courses required for the minor (breadth courses and the capstone project course) are (all existing courses):

**Mathematics**
- MATH 1501 Calculus I 4
- MATH 1502 Calculus II 4
- MATH 2401 Calculus III 4

**Physics**
- PHYS 2211 Introductory Physics I 4
- PHYS 2212 Introductory Physics II 4

**Chemistry**
- CHEM 1310 General Chemistry 4
or CHEM 12 Chemical Principles I

**Economics**
Select one of the following: 3-6
- ECON 2100 Economic Analysis and Policy Problems
- or ECON 2105 Principles of Macroeconomics
- & ECON 2106 Principles of Microeconomics

**Requirements**

**Depth Courses**
- ECON 4440 Economics of Natural Resources and the Environment 3
- ECON 4340 Economics of Industrial Competition 3

**Breadth Courses**
Select 6 credit hours from the following: 2 6
- ME 3700 Introduction to Energy Systems Engineering
- PUBP 3350 Energy Policy
- CHEM 3700 The Science of Alternative Energy

**Capstone Course**
GT 4813 Project in Energy Systems 3 3

Total Credit Hours 15

1 The Depth Courses may have additional prerequisites; please check the current prerequisites (http://www.catalog.gatech.edu/academics/courses).

2 Students should strive to complete the necessary prerequisites and the depth courses prior to enrolling in the breadth courses. However, depth courses may be taken concurrently with the courses taken to meet the breadth requirement.

3 Ordinarily, students must complete all minor requirements before they can register for the Project in Energy Systems course.

**Program of Study - Track for Economics (including EIA, and GEML) Students**
The minor includes requirements for courses which cut across disciplines. These courses are intended to add breadth of knowledge in areas outside the student’s major but important to energy systems. A terminal “capstone” or project course provides an opportunity for students from multiple disciplines to work together in multidisciplinary teams on a significant project in the energy area.

The breadth courses and the capstone project course, courses taken by all students completing the minor, require one or more prerequisites; specifically, basic economics, mathematics, and lab science courses. The minor must consist of at least 15 credit hours and all courses in the minor also must be 3000 level and above.

A multidisciplinary or other minor may contain courses in a student’s major field of study. A maximum of 6 credit hours of such courses may be used to satisfy the course requirements for the minor, provided these courses are not also used to satisfy any course requirement in the student’s major degree program.

All courses counting toward the minor must be taken on a letter-grade basis and completed with a grade of C (2.00) or better.

All courses in the minor also must be 3000 level and above.
Program of Study - Track for Public Policy Students

The minor includes requirements for courses which cut across disciplines. These courses are intended to add breadth of knowledge in areas outside the student’s major but important to energy systems. A terminal “capstone” or project course provides an opportunity for students from multiple disciplines to work together in multidisciplinary teams on a significant project in the energy area.

The breadth courses and the capstone project course, courses taken by all students completing the minor, require one or more prerequisites; specifically, basic economics, mathematics, and lab science courses. The minor must consist of at least 15 credit hours and all courses in the minor also must be 3000 level and above.

A multidisciplinary or other minor may contain courses in a student’s major field of study. A maximum of 6 credit hours of such courses may be used to satisfy the course requirements for the minor, provided these courses are not also used to satisfy any course requirement in the student’s major degree program.

All courses counting toward the minor must be taken on a letter-grade basis and completed with a grade of C (2.00) or better.

All courses in the minor also must be 3000 level and above.

Prerequisite Courses

Students ordinarily pursue the minor upon completion of the needed prerequisites. However, the depth course requirements may be taken as soon as students have met the relevant prerequisites.

The prerequisites needed for one or more of the courses required for the minor (breadth courses and the capstone project course) are (all existing courses):

Mathematics

<table>
<thead>
<tr>
<th>Course</th>
<th>Description</th>
<th>Credit Hours</th>
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<tbody>
<tr>
<td>MATH 1501</td>
<td>Calculus I</td>
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<tr>
<td>MATH 1502</td>
<td>Calculus II</td>
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</tr>
<tr>
<td>MATH 2401</td>
<td>Calculus III</td>
<td>4</td>
</tr>
</tbody>
</table>

Physics

<table>
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<tr>
<th>Course</th>
<th>Description</th>
<th>Credit Hours</th>
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</thead>
<tbody>
<tr>
<td>PHYS 2211</td>
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<td>4</td>
</tr>
<tr>
<td>PHYS 2212</td>
<td>Introductory Physics II</td>
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Chemistry

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<th>Description</th>
<th>Credit Hours</th>
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</thead>
<tbody>
<tr>
<td>CHEM 1310</td>
<td>General Chemistry</td>
<td>4</td>
</tr>
<tr>
<td>or CHEM 121</td>
<td>Chemical Principles I</td>
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</tr>
</tbody>
</table>

Economics

Select one of the following:

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<thead>
<tr>
<th>Course</th>
<th>Description</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECON 2100</td>
<td>Economic Analysis and Policy Problems</td>
<td>3-6</td>
</tr>
<tr>
<td>or ECON 2106</td>
<td>The Global Economy</td>
<td></td>
</tr>
<tr>
<td>ECON 2105</td>
<td>Principles of Macroeconomics &amp; Principles of Microeconomics</td>
<td></td>
</tr>
</tbody>
</table>

Requirements

Depth Courses

Select 6 credit hours of depth courses related to energy systems:

<table>
<thead>
<tr>
<th>Course</th>
<th>Description</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>PUBP 3315</td>
<td>Environmental Policy and Politics</td>
<td>6</td>
</tr>
<tr>
<td>PUBP 3600</td>
<td>Sustainability, Technology, and Policy</td>
<td></td>
</tr>
</tbody>
</table>

Breadth Courses

Select 6 credit hours from the following:

<table>
<thead>
<tr>
<th>Course</th>
<th>Description</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>ME 3700</td>
<td>Introduction to Energy Systems Engineering</td>
<td>6</td>
</tr>
<tr>
<td>ECON 3300</td>
<td>Economics of International Energy Markets</td>
<td></td>
</tr>
<tr>
<td>CHEM 3700</td>
<td>The Science of Alternative Energy</td>
<td></td>
</tr>
</tbody>
</table>

Capstone Course

<table>
<thead>
<tr>
<th>Course</th>
<th>Description</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>GT 4813</td>
<td>Project in Energy Systems</td>
<td>3</td>
</tr>
</tbody>
</table>

Total Credit Hours

15

1 The Depth Courses may have additional prerequisites; please check the current prerequisites (http://www.catalog.gatech.edu/academics/courses).

2 Students should strive to complete the necessary prerequisites and the breadth courses prior to enrolling in the breadth courses. However, depth courses may be taken concurrently with the courses taken to meet the breadth requirement.

3 Ordinarily, students must complete all minor requirements before they can register for the Project in Energy Systems course.

Program of Study - Track for Biology Students

The minor includes requirements for courses which cut across disciplines. These courses are intended to add breadth of knowledge in areas outside the student’s major but important to energy systems. A terminal “capstone” or project course provides an opportunity for students from multiple disciplines to work together in multidisciplinary teams on a significant project in the energy area.

The breadth courses and the capstone project course, courses taken by all students completing the minor, require one or more prerequisites; specifically, basic economics, mathematics, and lab science courses. The minor must consist of at least 15 credit hours and all courses in the minor also must be 3000 level and above.

A multidisciplinary or other minor may contain courses in a student’s major field of study. A maximum of 6 credit hours of such courses may be used to satisfy the course requirements for the minor, provided these courses are not also used to satisfy any course requirement in the student’s major degree program.

All courses counting toward the minor must be taken on a letter-grade basis and completed with a grade of C (2.00) or better.

All courses in the minor also must be 3000 level and above.
Prerequisite Courses

Students ordinarily pursue the minor upon completion of the needed prerequisites. However, the depth course requirements may be taken as soon as students have met the relevant prerequisites.

The prerequisites needed for one or more of the courses required for the minor (breadth courses and the capstone project course) are (all existing courses):

**Mathematics**
- MATH 1501 Calculus I
- MATH 1502 Calculus II
- MATH 2401 Calculus III

**Physics**
- PHYS 2211 Introductory Physics I
- PHYS 2212 Introductory Physics II

**Chemistry**
- CHEM 1310 General Chemistry
- CHEM 4511/4512 Introductory Chemistry

**Economics**
- ECON 2100 Macroeconomics
- ECON 2100 Microeconomics

**Requirements**

**Depth Courses**
Select 6 credit hours of depth courses related to energy systems:¹

- BIOL 4221 Biological Oceanography
- BIOL 4410 Microbial Ecology
- BIOL 4418 Microbial Physiology
- BIOL 4440 Plant Physiology
- CHEM 3511 Biochemistry, Survey of Biochemistry
- CHEM 4511 Biochemistry I
- CHEM 4512 Biochemistry II
- EAS 4410 Climate and Global Change
- EAS 3110 Energy, Environment, and Society

**Breadth Courses**
Select 6 credit hours from the following:²

- ME 3700 Introduction to Energy Systems Engineering
- ECON 3300 Economics of International Energy Markets
- PUBP 3350 Energy Policy

**Capstone Course**
- GT 4813 Project in Energy Systems³

Total Credit Hours 15

¹ The Depth Courses may have additional prerequisites; please check the current prerequisites (http://www.catalog.gatech.edu/academics/courses).
² Students should strive to complete the necessary prerequisites and the depth courses prior to enrolling in the breadth courses. However, depth courses may be taken concurrently with the courses taken to meet the breadth requirement.
³ Ordinarily, students must complete all minor requirements before they can register for the Project in Energy Systems course.

**Program of Study - Track for Chemistry and Biochemistry Students**

The minor includes requirements for courses which cut across disciplines. These courses are intended to add breadth of knowledge in areas outside the student’s major but important to energy systems. A terminal “capstone” or project course provides an opportunity for students from multiple disciplines to work together in multidisciplinary teams on a significant project in the energy area.

The breadth courses and the capstone project course, courses taken by all students completing the minor, require one or more prerequisites; specifically, basic economics, mathematics, and lab science courses. The minor must consist of at least 15 credit hours and all courses in the minor also must be 3000 level and above.

A multidisciplinary or other minor may contain courses in a student’s major field of study. A maximum of 6 credit hours of such courses may be used to satisfy the course requirements for the minor, provided these courses are not also used to satisfy any course requirement in the student’s major degree program.

1. Courses at the 1000 level may NOT be used toward the minor.
2. A maximum of 3 credit hours of Special Topics (in biochemistry) courses may be included in the minimum 15 credit hours of a minor program.
3. A maximum of 3 credit hours of CHEM 4699 may be used toward the minor.
4. All courses counting toward the minor must be completed with an overall average GPA of at least 2.0.
5. All courses counting toward the minor must be completed with a letter grade basis.
6. A maximum of 3 credit hours of transfer credit may be used to satisfy the course requirements for a minor. This includes courses taken at another institution or credit earned through the AP or IB program, assuming the scores meet Georgia Tech minimum standards.
7. It is the major advisor’s responsibility to verify that students are using only courses from the designated block(s) from the student’s major field of study that are allowed to satisfy a minor program, that they are not using any Core Area A-E courses (including humanities and social sciences), and that they are not using any courses for more than one minor or certificate. Any free elective course used to satisfy the course requirements of the student’s major degree program may also be used to satisfy the course requirements for a minor.
Prerequisite Courses

Students ordinarily pursue the minor upon completion of the needed prerequisites. However, the depth course requirements may be taken as soon as students have met the relevant prerequisites.

The prerequisites needed for one or more of the courses required for the minor (breadth courses and the capstone project course) are (all existing courses):

**Mathematics**
- MATH 1501 Calculus I 4
- MATH 1502 Calculus II 4
- MATH 2401 Calculus III 4

**Physics**
- PHYS 2211 Introductory Physics I 4
- PHYS 2212 Introductory Physics II 4

**Chemistry**
- CHEM 1310 General Chemistry 4
  or CHEM 1211K
- CHEM 4XXX or CHEM 1211K

**Economics**
Select one of the following: 3-6
- ECON 2100 Economic Analysis and Policy Problems
- or ECON The Global Economy
- ECON 2105 Principles of Macroeconomics
  & ECON 2106 Principles of Microeconomics

Requirements

**Depth Courses**
Select 6 credit hours of depth courses related to energy systems.¹

- CHEM 3511 Biochemistry, Survey of Biochemistry
- CHEM 4113 Applications of Inorganic Chemistry in Current Energy Research
- CHEM 4XXX Chemistry Elective
  or CHEM 3511 Biochemistry, Survey of Biochemistry
- CHEM 4XXX Chemistry Elective
  or CHEM 4113 Applications of Inorganic Chemistry in Current Energy Research

**Breadth Courses**
Select 6 credit hours from the following:²

- ME 3700 Introduction to Energy Systems Engineering
- ECON 3300 Economics of International Energy Markets
- PUBP 3350 Energy Policy

**Capstone Course**
GT 4813 Project in Energy Systems ³

Total Credit Hours 15

¹ The Depth Courses may have additional prerequisites; please check the current prerequisites (http://www.catalog.gatech.edu/academics/courses).

² A list of acceptable courses which meet the depth requirement is provided by each major approving the minor. Depth courses may be taken in the student’s major to ensure the depth in that major needed to pursue a multidisciplinary minor. All acceptable depth courses must be consistent with the goals of the minor. Examples of acceptable courses include science courses which cover energy science like biomass or other relevant basic science.

² Students should strive to complete the necessary prerequisites and the depth courses prior to enrolling in the breadth courses. However, depth courses may be taken concurrently with the courses taken to meet the breadth requirement.

² Breadth courses may ordinarily serve as technical or free electives in the student’s program of study. However, courses required by name and number and/or used to satisfy Core Areas A through E cannot be used to satisfy the requirements of a minor.

³ Ordinarily, students must complete all minor requirements before they can register for the Project in Energy Systems course.

Program of Study - Track for Earth and Atmospheric Sciences Students

The minor includes requirements for courses which cut across disciplines. These courses are intended to add breadth of knowledge in areas outside the student’s major but important to energy systems. A terminal “capstone” or project course provides an opportunity for students from multiple disciplines to work together in multidisciplinary teams on a significant project in the energy area.

The breadth courses and the capstone project course, courses taken by all students completing the minor, require one or more prerequisites; specifically, basic economics, mathematics, and lab science courses. The minor must consist of at least 15 credit hours and all courses in the minor also must be 3000 level and above.

A multidisciplinary or other minor may contain courses in a student’s major field of study. A maximum of 6 credit hours of such courses may be used to satisfy the course requirements for the minor, provided these courses are not also used to satisfy any course requirement in the student’s major degree program.

All courses counting toward the minor must be taken on a letter-grade basis and completed with a grade of C (2.00) or better.

All courses in the minor also must be 3000 level and above.

Prerequisite Courses

Students ordinarily pursue the minor upon completion of the needed prerequisites. However, the depth course requirements may be taken as soon as students have met the relevant prerequisites.

The prerequisites needed for one or more of the courses required for the minor (breadth courses and the capstone project course) are (all existing courses):

**Mathematics**
- MATH 1501 Calculus I 4
- MATH 1502 Calculus II 4
- MATH 2401 Calculus III 4

**Physics**
- PHYS 2211 Introductory Physics I 4
- PHYS 2212 Introductory Physics II 4

**Chemistry**
- CHEM 1310 General Chemistry 4
  or CHEM 1211K

**Economics**
Select one of the following: 3-6
- ECON 2100 Economic Analysis and Policy Problems
  or ECON The Global Economy
ECON 2105 Principles of Macroeconomics  
& ECON 2106 Principles of Microeconomics

**Requirements**

**Depth Courses**

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<thead>
<tr>
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<tbody>
<tr>
<td>EAS 4410</td>
<td>Climate and Global Change ¹</td>
<td>3</td>
</tr>
<tr>
<td>EAS 3110</td>
<td>Energy, Environment, and Society ¹</td>
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**Breadth Courses**

Select 6 credit hours from the following: ²

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<tr>
<td>PUBP 3350</td>
<td>Energy Policy</td>
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**Capstone Course**

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<th>Credits</th>
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<tbody>
<tr>
<td>GT 4813</td>
<td>Project in Energy Systems ³</td>
<td>3</td>
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**Total Credit Hours** 15

¹ The Depth Courses may have additional prerequisites; please check the current prerequisites (http://www.catalog.gatech.edu/academics/courses).
² A list of acceptable courses which meet the depth requirement is provided by each major approving the minor. Depth courses may be taken in the student's major to ensure the depth in that major needed to pursue a multidisciplinary minor. All acceptable depth courses must be consistent with the goals of the minor. Examples of acceptable courses include science courses which cover energy science like biomass or other relevant basic science.
³ Ordinarily, students must complete all minor requirements before they can register for the Project in Energy Systems course.

**Additional Guidelines**

- A maximum of 6 credit hours of Special Topics courses may be included in a minor program or the student may complete 3 credit hours of Special Topics and 3 credit hours of either Special Problems or Undergraduate Research.
- A maximum of 3 credit hours of transfer credit may be used to satisfy the course requirements for a minor. This includes courses taken at another institution or credit earned through the AP or IB program, assuming the scores meet Georgia Tech minimum standards.
- It is the **major advisor's responsibility** to verify that students are using only courses from the designated block(s) from the student's major field of study that are allowed to satisfy a minor program, that they are not using any Core Area A-E courses (including humanities and social sciences), and that they are not using any courses for more than one minor or certificate. Any free elective course used to satisfy the course requirements of the student's major degree program may also be used to satisfy the course requirements for a minor.