ENERGY AND MINERAL ENGINEERING

Integrated Undergrad-Grad Programs

The EME graduate program offers integrated B.S./M.S. programs designed to allow academically superior and research-focused undergraduate students in five B.S. degree programs—Energy Business and Finance; Energy Engineering; Environmental Systems Engineering; Mining Engineering; and Petroleum and Natural Gas Engineering—also to obtain an M.S. degree in Energy and Mineral Engineering (EME) within five years of study.

Integrated B.S. in Energy Business and Finance and M.S. in Energy and Mineral Engineering

Requirements listed here are in addition to requirements listed in GCAC-210 Integrated Undergraduate-Graduate (IUG) Degree Programs (http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-210-integrated-undergraduate-graduate-degree-programs/).

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (http://gradschool.psu.edu/prospective-students/how-to-apply/). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (http://gradschool.psu.edu/graduate-education-policies/).

Students must apply to the program via the Graduate School application for admission (http://gradschool.psu.edu/prospective-students/how-to-apply/), and must meet all the admission requirements of the Graduate School and the EME graduate program for the Master of Science degree. Undergraduate students with sixth semester standing and minimum grade-point average of 3.5 who wish to complete the Integrated B.S./M.S. program should apply to the Graduate School and the EME IUG program before the end of their junior year. Before applying to the Graduate School, students must have completed entrance to their undergraduate major and have completed no less than 60 credits. Students must be admitted no later than the end of the second week of the semester preceding the semester of expected conferral of the undergraduate degree. Transfer students must have completed at least 15 credits at Penn State to enroll in an IUG.

Three faculty letters of recommendation are required. A statement of purpose and a plan of study covering the five year period, prepared in consultation with an adviser, and approved by the program officers of the B.S. major and the EME graduate program must accompany the application. The plan should be presented to the undergraduate and graduate program officers prior to being admitted into the program. The plan should cover the entire time period of the integrated program, and it should be reviewed periodically by an adviser as the student advances through the program. Graduate Record Examination (GRE) scores may be submitted by IUG applicants but are not required. The application will be reviewed by the Admissions Committee of the EME Graduate program and acted upon by the EME Graduate Program Officer.

Degree Requirements

Students must fulfill all degree requirements for each degree in order to be awarded that degree, subject to the double-counting of credits as outlined below. Degree requirements for the Bachelor of Science degrees are listed in the Undergraduate Bulletin (https://bulletins.psu.edu/undergraduate/). Degree requirements for the Master of Science in EME are listed in the Master of Science Degree Requirements section above. Students must sequence their courses so all undergraduate degree requirements are fulfilled before taking courses to count solely towards the graduate degree. Students are expected to complete the undergraduate degree requirements within the typical time to degree for the undergraduate major. In the semester in which the undergraduate degree requirements will be completed, IUG students must apply to graduate, and the undergraduate degree should be conferred at the next appropriate Commencement. If students accepted into the IUG program are unable to complete the M.S. degree, they are still eligible to receive their undergraduate degree if all the undergraduate degree requirements have been satisfied.

Up to 12 credits may be double-counted towards the degree requirements for both the graduate and undergraduate degrees; a minimum of 50% of the double-counted courses must be at the 500 or 800 level. Independent study courses and credits associated with the culminating experience for the graduate degree cannot be double-counted.

The courses that will double count are: six (6) credits of the two 500-level EME core courses taken to satisfy M.S. core requirement and an additional six (6) credits of 400-level courses taken to satisfy 7th and 8th semester core courses from the undergraduate degree:

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>EBF 401</td>
<td>Strategic Corporate Finance for the Earth, Energy, and Materials Industries</td>
<td>3</td>
</tr>
<tr>
<td>EBF 473</td>
<td>Risk Management in Energy Industries</td>
<td>3</td>
</tr>
<tr>
<td>EME 501</td>
<td>Design Under Uncertainty in Energy and Mineral Systems</td>
<td>3</td>
</tr>
<tr>
<td>EME 511</td>
<td>Interfacial Physical-Chemical Systems, Processes, and Measurements</td>
<td>3</td>
</tr>
<tr>
<td>EME 521</td>
<td>Mathematical Modeling of Energy and Mineral Systems</td>
<td>3</td>
</tr>
<tr>
<td>EME 531</td>
<td>Thermodynamics of Energy and Mineral Systems</td>
<td>3</td>
</tr>
<tr>
<td>EME 551</td>
<td>Safety, Health and Environmental Risks in Energy and Mineral Production</td>
<td>3</td>
</tr>
</tbody>
</table>

Integrated B.S. in Energy Engineering and M.S. in Energy and Mineral Engineering

Requirements listed here are in addition to requirements listed in GCAC-210 Integrated Undergraduate-Graduate (IUG) Degree Programs (http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-210-integrated-undergraduate-graduate-degree-programs/).

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (http://gradschool.psu.edu/prospective-students/how-to-apply/). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (http://gradschool.psu.edu/graduate-education-policies/).

Students must apply to the program via the Graduate School application for admission (http://gradschool.psu.edu/prospective-students/how-to-apply/), and must meet all the admission requirements of the Graduate School and the EME graduate program for the Master of Science degree. Undergraduate students with sixth semester standing and minimum grade-point average of 3.5 who wish to complete the Integrated B.S./M.S. program should apply to the Graduate School and the EME IUG program before the end of their junior year. Before applying to the Graduate
School, students must have completed entrance to their undergraduate major and have completed no less than 60 credits. Students must be admitted no later than the end of the second week of the semester preceding the semester of expected conferment of the undergraduate degree. Transfer students must have completed at least 15 credits at Penn State to enroll in an IUG.

Three faculty letters of recommendation are required. A statement of purpose and a plan of study covering the five year period, prepared in consultation with an adviser, and approved by the program officers of the B.S. major and the EME graduate program must accompany the application. The plan should be presented to the undergraduate and graduate program officers prior to being admitted into the program. The plan should cover the entire time period of the integrated program, and it should be reviewed periodically with an adviser as the student advances through the program. Graduate Record Examination (GRE) scores may be submitted by IUG applicants but are not required. The application will be reviewed by the Admissions Committee of the EME Graduate program and acted upon by the EME Graduate Program Officer.

### Degree Requirements

Students must fulfill all degree requirements for each degree in order to be awarded that degree, subject to the double-counting of credits as outlined below. Degree requirements for the Bachelor of Science degrees are listed in the Undergraduate Bulletin (https://bulletins.psu.edu/undergraduate/). Degree requirements for the Master of Science in EME are listed in the Master of Science Degree Requirements section above. Students must sequence their courses so all undergraduate degree requirements are fulfilled before taking courses to count solely towards the graduate degree. Students are expected to complete the undergraduate degree requirements within the typical time to degree for the undergraduate major. In the semester in which the undergraduate degree requirements will be completed, IUG students must apply to the undergraduate and graduate program officers prior to being admitted into the program. Three faculty letters of recommendation are required. A statement of purpose and a plan of study covering the five year period, prepared in consultation with an adviser, and approved by the program officers of the B.S. major and the EME graduate program must accompany the application. The plan should be presented to the undergraduate and graduate program officers prior to being admitted into the program. The plan should cover the entire time period of the integrated program, and it should be reviewed periodically with an adviser as the student advances through the program. Graduate Record Examination (GRE) scores may be submitted by IUG applicants but are not required. The application will be reviewed by the Admissions Committee of the EME Graduate program and acted upon by the EME Graduate Program Officer.

### Code | Title                                      | Credits |
--- | --- | --- |
EGEE 441 | Electrochemical Engineering Fundamentals | 3 |
EGEE 451 | Energy Conversion Processes | 3 |
EGEE 464W | Energy Design Project | 3 |
EME 460 | Geo-resource Evaluation and Investment Analysis | 3 |
EME 501 | Design Under Uncertainty in Energy and Mineral Systems | 3 |
EME 511 | Interfacial Physical-Chemical Systems, Processes, and Measurements | 3 |
EME 521 | Mathematical Modeling of Energy and Mineral Systems | 3 |
EME 531 | Thermodynamics of Energy and Mineral Systems | 3 |
EME 551 | Safety, Health and Environmental Risks in Energy and Mineral Production | 3 |
FSC 432 | Petroleum Processing | 3 |

### Integrated B.S. in Environmental Systems Engineering and M.S. in Energy and Mineral Engineering

Requirements listed here are in addition to requirements listed in GCAC-210 Integrated Undergraduate-Graduate (IUG) Degree Programs (http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-210-integrated-undergraduate-graduate-degree-programs/).

### Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (http://gradschool.psu.edu/prospective-students/how-to-apply/). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (http://gradschool.psu.edu/graduate-education-policies/).

Students must apply to the program via the Graduate School application for admission (http://gradschool.psu.edu/prospective-students/how-to-apply/), and must meet all the admission requirements of the Graduate School and the EME graduate program for the Master of Science degree.

Undergraduate students with sixth semester standing and minimum grade-point average of 3.5 who wish to complete the Integrated B.S./M.S. program should apply to the Graduate School and the EME IUG program before the end of their junior year. Before applying to the Graduate School, students must have completed entrance to their undergraduate major and have completed no less than 60 credits. Students must be admitted no later than the end of the second week of the semester preceding the semester of expected conferment of the undergraduate degree. Transfer students must have completed at least 15 credits at Penn State to enroll in an IUG.

Three faculty letters of recommendation are required. A statement of purpose and a plan of study covering the five year period, prepared in consultation with an adviser, and approved by the program officers of the B.S. major and the EME graduate program must accompany the application. The plan should be presented to the undergraduate and graduate program officers prior to being admitted into the program. The plan should cover the entire time period of the integrated program, and it should be reviewed periodically with an adviser as the student advances through the program. Graduate Record Examination (GRE) scores may be submitted by IUG applicants but are not required. The application will be reviewed by the Admissions Committee of the EME Graduate program and acted upon by the EME Graduate Program Officer.

### Degree Requirements

Students must fulfill all degree requirements for each degree in order to be awarded that degree, subject to the double-counting of credits as outlined below. Degree requirements for the Bachelor of Science degrees are listed in the Undergraduate Bulletin (https://bulletins.psu.edu/undergraduate/). Degree requirements for the Master of Science in EME are listed in the Master of Science Degree Requirements section above. Students must sequence their courses so all undergraduate degree requirements are fulfilled before taking courses to count solely towards the graduate degree. Students are expected to complete the undergraduate degree requirements within the typical time to degree for the undergraduate major. In the semester in which the undergraduate degree requirements will be completed, IUG students must apply to...
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Up to 12 credits may be double-counted towards the degree requirements for both the graduate and undergraduate degrees; a minimum of 50% of the double-counted courses must be at the 500 or 800 level. Independent study courses and credits associated with the culminating experience for the graduate degree cannot be double-counted.

The courses that will double count are: six (6) credits of the two 500-level EME core courses taken to satisfy M.S. core requirement and an additional six (6) credits of 400-level courses taken to satisfy 7th and 8th semester core courses from the undergraduate degree:

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<td>Design Under Uncertainty in Energy and Mineral Systems</td>
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<td>EME 511</td>
<td>Interfacial Physical-Chemical Systems, Processes, and Measurements</td>
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<td>Safety, Health and Environmental Risks in Energy and Mineral Production</td>
<td>3</td>
</tr>
<tr>
<td>ENVSE 404W</td>
<td>Surface and Interfacial Phenomena in Environmental Systems</td>
<td>3</td>
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<td>ENVSE 427</td>
<td>Pollution Control in the Process Industries</td>
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<td>Environmental Health and Safety</td>
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<td>ENVSE 457</td>
<td>Industrial Hygiene Measurements</td>
<td>3</td>
</tr>
<tr>
<td>ENVSE 470</td>
<td>Engineering Risk Analysis</td>
<td>3</td>
</tr>
<tr>
<td>ENVSE 480</td>
<td>Environmental Systems Engineering Process Design</td>
<td>3</td>
</tr>
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</table>

### Integrated B.S. in Mining Engineering and M.S. in Energy and Mineral Engineering

Requirements listed here are in addition to requirements listed in GCAC-210 Integrated Undergraduate-Graduate (IUG) Degree Programs (http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-210-integrated-undergraduate-graduate-degree-programs/).

### Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (http://gradschool.psu.edu/prospective-students/how-to-apply/). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (http://gradschool.psu.edu/graduate-education-policies/).

Students must apply to the program via the Graduate School application for admission (http://gradschool.psu.edu/prospective-students/how-to-apply/), and must meet all the admission requirements of the Graduate School and the EME graduate program for the Master of Science degree. Undergraduate students with sixth semester standing and minimum grade-point average of 3.5 who wish to complete the Integrated B.S./M.S. program should apply to the Graduate School and the EME IUG program before the end of their junior year. Before applying to the Graduate School, students must have completed entrance to their undergraduate major and have completed no less than 60 credits. Students must be admitted no later than the end of the second week of the semester preceding the semester of expected conferral of the undergraduate degree. Transfer students must have completed at least 15 credits at Penn State to enroll in an IUG.

Three faculty letters of recommendation are required. A statement of purpose and a plan of study covering the five year period, prepared in consultation with an adviser, and approved by the program officers of the B.S. major and the EME graduate program must accompany the application. The plan should be presented to the undergraduate and graduate program officers prior to being admitted into the program. The plan should cover the entire time period of the integrated program, and it should be reviewed periodically with an adviser as the student advances through the program. Graduate Record Examination (GRE) scores may be submitted by IUG applicants but are not required. The application will be reviewed by the Admissions Committee of the EME Graduate program and acted upon by the EME Graduate Program Officer.

### Degree Requirements

Students must fulfill all degree requirements for each degree in order to be awarded that degree, subject to the double-counting of credits as outlined below. Degree requirements for the Bachelor of Science degrees are listed in the Undergraduate Bulletin (https://bulletins.psu.edu/undergraduate/). Degree requirements for the Master of Science in EME are listed in the Master of Science Degree Requirements section above. Students must sequence their courses so all undergraduate degree requirements are fulfilled before taking courses to count solely towards the graduate degree. Students are expected to complete the undergraduate degree requirements within the typical time to degree for the undergraduate major. In the semester in which the undergraduate degree requirements will be completed, IUG students must apply to graduate, and the undergraduate degree should be conferred at the next appropriate Commencement. If students accepted into the IUG program are unable to complete the M.S. degree, they are still eligible to receive their undergraduate degree if all the undergraduate degree requirements have been satisfied.

Up to 12 credits may be double-counted towards the degree requirements for both the graduate and undergraduate degrees; a minimum of 50% of the double-counted courses must be at the 500 or 800 level. Independent study courses and credits associated with the culminating experience for the graduate degree cannot be double-counted.

The courses that will double count are: six (6) credits of the two 500-level EME core courses taken to satisfy M.S. core requirement and an additional six (6) credits of 400-level courses taken to satisfy 7th and 8th semester core courses from the undergraduate degree:

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### Courses Eligible to Double Count for Both Degrees

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<td>ENVSE 480</td>
<td>Environmental Systems Engineering Process Design</td>
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**Energy and Mineral Engineering**
are unable to complete the M.S. degree, they are still eligible to receive
graduate, and the undergraduate degree should be conferred at the next
degree requirements will be completed, IUG students must apply to
undergraduate major. In the semester in which the undergraduate
undergraduate degree requirements within the typical time to degree for
students are expected to complete the undergraduate degree requirements
are listed in the Master of Science Degree Requirements section
EME are listed in the Undergraduate Bulletin (https://bulletins.psu.edu/
Undergraduate/). Degree requirements for the Bachelor of Science degrees
are listed in the Undergraduate Bulletin (https://bulletins.psu.edu/
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degree requirements are fulfilled before taking courses to count solely
towards the graduate degree. Students are expected to complete the
undergraduate degree requirements within the typical time to degree for
the undergraduate major. In the semester in which the undergraduate
degree requirements will be completed, IUG students must apply to
graduate, and the undergraduate degree should be conferred at the next
appropriate Commencement. If students accepted into the IUG program
are unable to complete the M.S. degree, they are still eligible to receive
their undergraduate degree if all the undergraduate degree requirements
have been satisfied.
Up to 12 credits may be double-counted towards the degree requirements
for both the graduate and undergraduate degrees; a minimum of 50% of
the double-counted courses must be at the 500 or 800 level. Independent
study courses and credits associated with the culminating experience for
the graduate degree cannot be double-counted.

The courses that will double count are: six (6) credits of the two 500-
level EME core courses taken to satisfy M.S. core requirement and an
additional six (6) credits of 400-level courses taken to satisfy 7th and 8th
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<tr>
<td>EME 551</td>
<td>Safety, Health and Environmental Risks in Energy and Mineral Production</td>
<td>3</td>
</tr>
<tr>
<td>PNG 420</td>
<td>Applied Reservoir Analysis and Secondary Recovery</td>
<td>3</td>
</tr>
<tr>
<td>PNG 425</td>
<td>Principles of Well Testing and Evaluation</td>
<td>3</td>
</tr>
<tr>
<td>PNG 430</td>
<td>Reservoir Modeling</td>
<td>3</td>
</tr>
<tr>
<td>PNG 440W</td>
<td>Formation Evaluation</td>
<td>3</td>
</tr>
<tr>
<td>PNG 480</td>
<td>Surface Production Engineering</td>
<td>3</td>
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</tbody>
</table>

Integrated B.S. in Petroleum and Natural Gas Engineering and M.S. in Energy and Mineral Engineering
Requirements listed here are in addition to requirements listed in
GCAC-210 Integrated Undergraduate-Graduate (IUG) Degree Programs
(http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/
gcac-210-integrated-undergraduate-graduate-degree-programs/).

Admission Requirements
Applicants apply for admission to the program via the Graduate School
application for admission (http://gradschool.psu.edu/prospective-
students/how-to-apply/). Requirements listed here are in addition to
Graduate Council policies listed under GCAC-300 Admissions Policies
(http://gradschool.psu.edu/graduate-education-policies/).

Students must apply to the program via the Graduate School application
for admission (http://gradschool.psu.edu/prospective-students/how-to-apply/),
and must meet all the admission requirements of the Graduate School
and the EME graduate program for the Master of Science degree.
Undergraduate students with sixth semester standing and minimum
grade-point average of 3.5 who wish to complete the Integrated B.S./M.S.
program should apply to the Graduate School and the EME IUG program
before the end of their junior year. Before applying to the Graduate
School, students must have completed entrance to their undergraduate
major and have completed no less than 60 credits. Students must be
admitted no later than the end of the second week of the semester
preceding the semester of expected conferral of the undergraduate
degree. Transfer students must have completed at least 15 credits at
Penn State to enroll in an IUG.

Three faculty letters of recommendation are required. A statement
of purpose and a plan of study covering the five year period, prepared in
consultation with an adviser, and approved by the program officers of
the B.S. major and the EME graduate program must accompany the
application. The plan should be presented to the undergraduate and
graduate program officers prior to being admitted into the program.
The plan should cover the entire time period of the integrated program,
and it should be reviewed periodically with an adviser as the student advances
through the program. Graduate Record Examination (GRE) scores may
be submitted by IUG applicants but are not required. The application will
be reviewed by the Admissions Committee of the EME Graduate program
and acted upon by the EME Program Officer.

Degree Requirements
Students must fulfill all degree requirements for each degree in order
to be awarded that degree, subject to the double-counting of credits as
outlined below. Degree requirements for the Bachelor of Science degrees
are listed in the Undergraduate Bulletin (https://bulletins.psu.edu/
undergraduate/). Degree requirements for the Master of Science in
EME are listed in the Master of Science Degree Requirements section
above. Students must sequence their courses so all undergraduate
degree requirements are fulfilled before taking courses to count solely
towards the graduate degree. Students are expected to complete the
undergraduate degree requirements within the typical time to degree for
the undergraduate major. In the semester in which the undergraduate
degree requirements will be completed, IUG students must apply to
graduate, and the undergraduate degree should be conferred at the next
appropriate Commencement. If students accepted into the IUG program
are unable to complete the M.S. degree, they are still eligible to receive

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<td>MNG 410</td>
<td>Underground Mining</td>
<td>3</td>
</tr>
<tr>
<td>MNG 441</td>
<td>Surface Mining Systems and Design</td>
<td>3</td>
</tr>
<tr>
<td>MNG 451W</td>
<td>Mining Engineering Project</td>
<td>1-5</td>
</tr>
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