

# MINING ENGINEERING, B.S.

**Begin Campus:** Any Penn State Campus

**End Campus:** University Park

## Program Description

Mining contributes to nearly 15 percent of the U.S. and 25 percent of the global economy. Mined products are significant and critical inputs to food production, manufacturing, construction, and electricity supply, and each year every person in the U.S. requires an average of 38,500 pounds of new minerals to equip and power their day-to-day activities. Over 14,000 mines distributed throughout the U.S. supply the majority of these mined products.

The Penn State Mining Engineering program prepares students for a career in the industrial minerals, metals, and energy industries that sustain the domestic and global economies. Importantly, the program provides an emphasis on sustainable mining through integration of environmental health and safety, and societal responsibility principles in the design and operation of mineral enterprises.

Graduates of the program will be prepared to work domestically or internationally to develop and operate mines; or to work in supporting activities including engineering consulting, banking, equipment development and supply, regulatory enforcement, and research. This is accomplished primarily through the curriculum, but is enhanced by an internship program, which allows qualified students to obtain practical experience through structured employment opportunities in the private and public sectors.

The curriculum is built on the foundation of mathematics, science, and general education common to engineering majors at Penn State. The courses specific to this major are designed and sequenced to provide an appropriate blend of theory, application, and design. The required courses help to provide the enabling skills for graduates to work in any facet of the vast minerals industry, and technical electives allow for in-depth study of more specialized topics. The general education opportunities are sufficiently broad and diverse in nature and scope to enable the student to tailor the educational experience to particular interests, backgrounds, and expected roles in society.

## Student-Trainee Program

An internship program and a five-year work-study plan are available to incoming students in Mining Engineering. Numerous mining and manufacturing companies, as well as government agencies, cooperate with the University to offer structured employment opportunities during the student's academic career. In addition to earning significant funds to help finance their education, these opportunities provide valuable practical and professional experience prior to graduation. The internships normally take place in the summer, and the B.S. degree can be earned in four years. The work-study plan consists of alternating six-month periods of employment and schooling, and requires five years to earn the B.S. degree. Additional information can be obtained from the department.

## What is Mining Engineering?

Mining engineers are driven by the need to extract materials required for daily life while being stewards of the environment. They enjoy working in a field where each day presents unique engineering challenges. The work can take place in the field—often in an out-of-the-office setting such as a surface or underground mine—or in an office setting, using

cutting-edge technology and software simulations to plan solutions to problems facing mining companies. Wherever mineral deposits exist—in remote areas or close to cities—the special skills of mining engineers are needed. Worldwide, mining companies extract more than 100 different commodities that are used in nearly every industrial sector, from transportation to manufacturing to agriculture to health care to defense. There's a saying in the mining industry: if it can't be grown, it has to be mined! Being a mining engineer puts you at the forefront of this critical part of the economy.

## You Might Like This Program If...

- You want to work in an out-of-the-office setting.
- You are a “hands-on” problem solver and like to get your hands dirty, both literally and figuratively.
- You want to apply different engineering disciplines to your problem solving, and prefer to not be focused on just one.
- You want to join a high-tech industry that provides the basic building blocks, minerals and other materials used in nearly every industry today.

## Entrance to Major

In order to be eligible for entrance to this major, a student must:

1. attain at least a C (2.00) cumulative grade-point average for all courses taken at the University; and
2. have third-semester classification ([http://www.registrar.psu.edu/registration/semester\\_classification.cfm](http://www.registrar.psu.edu/registration/semester_classification.cfm)).

READ SENATE POLICY 37-30: ENTRANCE TO AND CHANGES IN MAJOR PROGRAMS OF STUDY (<http://senate.psu.edu/policies-and-rules-for-undergraduate-students/37-00-entrance-to-a-college-or-major>)

## Degree Requirements

**For the Bachelor of Science degree in Mining Engineering, a minimum of 131 credits is required:**

Requirement	Credits
General Education	45
Requirements for the Major	113

**27 of the 45 credits for General Education are included in the Requirements for the Major. This includes: 9 credits of GN courses; 6 credits of GQ courses; 3 credits of GS courses; 6 credits of GWS courses; 3 credits of GH courses.**

## General Education

Connecting career and curiosity, the General Education curriculum provides the opportunity for students to acquire transferable skills necessary to be successful in the future and to thrive while living in interconnected contexts. General Education aids students in developing intellectual curiosity, a strengthened ability to think, and a deeper sense of aesthetic appreciation. These are requirements for all baccalaureate students and are often partially incorporated into the requirements of a program. For additional information, see the General Education Requirements (<http://bulletins.psu.edu/undergraduate/general-education/baccalaureate-degree-general-education-program>) section of the Bulletin and consult your academic adviser.

The keystone symbol appears next to the title of any course that is designated as a General Education course. Program requirements may also satisfy General Education requirements and vary for each program.

### Foundations (grade of C or better is required.)

- **Quantification (GQ):** 6 credits
- **Writing and Speaking (GWS):** 9 credits

### Knowledge Domains

- **Arts (GA):** 6 credits
- **Health and Wellness (GHW):** 3 credits
- **Humanities (GH):** 6 credits
- **Social and Behavioral Sciences (GS):** 6 credits
- **Natural Sciences (GN):** 9 credits

### Integrative Studies (may also complete a Knowledge Domain requirement)

- **Inter-Domain or Approved Linked Courses:** 6 credits

## University Degree Requirements

### First Year Engagement

All students enrolled in a college or the Division of Undergraduate Studies at University Park, and the World Campus are required to take 1 to 3 credits of the First-Year Seminar, as specified by their college First-Year Engagement Plan.

Other Penn State colleges and campuses may require the First-Year Seminar; colleges and campuses that do not require a First-Year Seminar provide students with a first-year engagement experience.

First-year baccalaureate students entering Penn State should consult their academic adviser for these requirements.

### Cultures Requirement

6 credits are required and may satisfy other requirements

- United States Cultures: 3 credits
- International Cultures: 3 credits

### Writing Across the Curriculum

3 credits required from the college of graduation and likely prescribed as part of major requirements.

### Total Minimum Credits

A minimum of 120 degree credits must be earned for a baccalaureate degree. The requirements for some programs may exceed 120 credits. Students should consult with their college or department adviser for information on specific credit requirements.

### Quality of Work

Candidates must complete the degree requirements for their major and earn at least a 2.00 grade-point average for all courses completed within their degree program.

### Limitations on Source and Time for Credit Acquisition

The college dean or campus chancellor and program faculty may require up to 24 credits of course work in the major to be taken at the location or in the college or program where the degree is earned. Credit used toward degree programs may need to be earned from a particular source or within time constraints (see Senate Policy 83-80 (<http://senate.psu.edu/policies-and-rules-for-undergraduate-students/82-00-and-83-00-degree-requirements/#83-80>)). For more information, check the Suggested Academic Plan for your intended program.

## Requirements for the Major

To graduate, a student enrolled in the major must earn a grade of C or better in each course designated by the major as a C-required course, as specified by Senate Policy 82-44 (<http://senate.psu.edu/policies-and-rules-for-undergraduate-students/82-00-and-83-00-degree-requirements/#82-44>).

Code	Title	Credits
<b>Prescribed Courses</b>		
CHEM 110	Chemical Principles I	3
CHEM 111	Experimental Chemistry I	1
ECON 102	Introductory Microeconomic Analysis and Policy	3
EDSGN 100	Introduction to Engineering Design	3
EE 211	Electrical Circuits and Power Distribution	3
EMCH 210	Statics and Strength of Materials	5
EME 460	Geo-resource Evaluation and Investment Analysis	3
EMSC 100S	Earth and Mineral Sciences First-Year Seminar <sup>1</sup>	3
GEOSC 201	Earth Materials	4
MATH 140	Calculus With Analytic Geometry I	4
MATH 141	Calculus with Analytic Geometry II	4
MATH 250	Ordinary Differential Equations	3
MNG 223	Mineral Land and Mine Surveying	2
MNG 331	Rock Mechanics	3
MNG 404	Mine Materials Handling Systems	2
MNG 410	Underground Mining	3
MNG 411	Mine Systems Engineering	2
MNG 422	Mine Ventilation and Air Conditioning	3
PHYS 211	General Physics: Mechanics	4
PHYS 212	General Physics: Electricity and Magnetism	4
PHYS 213	General Physics: Fluids and Thermal Physics	2
STAT 301	Statistical Analysis I	3
<i>Prescribed Courses: Require a grade of C or better</i>		
GEOSC 1	Physical Geology	3
MNG 230	Introduction to Mining Engineering	3
MNG 441	Surface Mining Systems and Design	3
MNG 451	Mining Engineering Project	4
MNPR 301	Elements of Mineral Processing	3
MNPR 413	Mineral Processing Laboratory	1
<b>Additional Courses</b>		
Select 23 credits, one course from each category:		23
A.		
ENGL 15	Rhetoric and Composition	
ENGL 30	Honors Freshman Composition	
B.		
PHIL 103	Introduction to Ethics	
PHIL 106	Business Ethics	
PHIL 107	Philosophy of Technology	
PHIL/STS 233	Ethics and the Design of Technology	
C.		
CMPSC 201	Programming for Engineers with C++	
CMPSC 202		
D.		
MATH 220	Matrices	

MATH 231	Calculus of Several Variables
E.	
EMCH 212	Dynamics
EMCH 212H	Dynamics
F.	
EME 301	Thermodynamics in Energy and Mineral Engineering
ME 300	Engineering Thermodynamics I
G.	
CE 360	Fluid Mechanics
EME 303	Fluid Mechanics in Energy and Mineral Engineering
H.	
GEOSC 470	Introduction to Field Geology
MNG 470	

#### Supporting Courses and Related Areas

Select 6 credits in consultation with adviser (students may apply 6 credits of ROTC) 6

<sup>1</sup> The following substitutions are allowed for students attending campuses where the indicated course is not offered: CAS 100 can be substituted for EMSC 100S.

## Integrated B.S. in Mining Engineering (MNGE) and M.S. in Energy and Mineral Engineering (EME)

The integrated undergraduate-graduate (IUG) program between the Mining Engineering undergraduate program and the Energy and Mineral Engineering graduate program enables academically superior and research-focused MNG E undergraduate students to also obtain an M.S. degree in Energy and Mineral Engineering in five years of study. Students should refer to the Energy and Mineral Engineering graduate program in the Graduate Program Bulletin (<http://bulletins.psu.edu/graduate/programs/majors/energy-mineral-engineering>) for the IUG admission and degree requirements.

### Course Substitutions for the Integrated B.S. in Mining Engineering (MNGE) and M.S. in Energy and Mineral Engineering (EME)

As many as twelve of the credits required for the master's degree may be applied to both the B.S. and M.S. degrees. A minimum of six credits counted for both the B.S. and M.S. degrees must be at the 500-level. Thesis and culminating/capstone experience credits may not be double counted. The undergraduate degree program officer will determine the specific undergraduate required courses for which the 500-level courses may be used to substitute to meet institutional and accreditation requirements.

## Program Educational Objectives

1. Within three to five years after graduation, students are expected to be advancing in their career in the minerals industry and adapting to new situations and emerging problems, through the application of general engineering-science skills and the core technical problem-solving and design practices of the mining engineering profession, with an understanding of the need for lifelong learning.

2. Within three to five years after graduation, students are expected to be communicating effectively.
3. Within three to five years after graduation, students are expected to be functioning effectively as individuals or as members of teams.
4. Within the first year after graduation, students are expected to demonstrate an understanding of the importance of mining to society, and for working in a contemporary society in which safety and health, responsibility to the environment, and ethical behavior are required, without exception.
5. Within the first five years after graduation, students are expected to be preparing to attain licensure as a Professional Engineer.

## Student Outcomes

Student outcomes describe what students are expected to know and be able to do by the time of graduation. The Mining Engineering program is designed to enable students to:

1. Identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
2. Apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
3. Communicate effectively with a range of audiences
4. Recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
5. Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
6. Develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
7. Acquire and apply new knowledge as needed, using appropriate learning strategies.

## Academic Advising

The objectives of the university's academic advising program are to help advisees identify and achieve their academic goals, to promote their intellectual discovery, and to encourage students to take advantage of both in-and out-of class educational opportunities in order that they become self-directed learners and decision makers.

Both advisers and advisees share responsibility for making the advising relationship succeed. By encouraging their advisees to become engaged in their education, to meet their educational goals, and to develop the habit of learning, advisers assume a significant educational role. The advisee's unit of enrollment will provide each advisee with a primary academic adviser, the information needed to plan the chosen program of study, and referrals to other specialized resources.

READ SENATE POLICY 32-00: ADVISING POLICY (<http://senate.psu.edu/policies-and-rules-for-undergraduate-students/32-00-advising-policy>)

### University Park

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## Suggested Academic Plan

The suggested academic plan(s) listed on this page are the plan(s) that are in effect during the 2019-20 academic year. To access previous years' suggested academic plans, please visit the archive (<http://bulletins.psu.edu/undergraduate/archive>) to view the appropriate Undergraduate Bulletin edition (*Note: the archive only contain suggested academic plans beginning with the 2018-19 edition of the Undergraduate Bulletin*).

### University Park Campus

The course series listed below provides **only one** of the many possible ways to move through this curriculum. The University may make changes in policies, procedures, educational offerings, and requirements at any time. This plan should be used in conjunction with your degree audit (accessible in LionPATH as either an **Academic Requirements** or **What If** report). Please consult with a Penn State academic adviser on a regular basis to develop and refine an academic plan that is appropriate for you.

#### First Year

Fall	Credits	Spring	Credits
MATH 140 or 140G (GQ) <sup>††</sup>	4	MATH 141 or 141G (GQ) <sup>††</sup>	4
CHEM 110 (GN) <sup>†</sup>	3	CMPSC 201 or 202	3
CHEM 111 (GN) <sup>†</sup>	1	ENGL 15, 30, or ESL 15 (GWS) <sup>††</sup>	3
EMSC 100S (or CAS 100 by substitution) (GWS) <sup>††1</sup>	3	PHYS 211 (GN) <sup>†</sup>	4
EDSGN 100	3	PHIL 103, 106, 107, or 233 (GH) <sup>†</sup>	3
ECON 102 (GS) <sup>†</sup>	3		
	17		17

#### Second Year

Fall	Credits	Spring	Credits
PHYS 212 (GN) <sup>†</sup>	4	PHYS 213	2
EMCH 210	5	EMCH 212	3
MNG 223 or CE 209	2	EME 301, ME 300, or ME 201	3
MATH 250	3	STAT 301 (If STAT 301 not available, take STAT 401 instead)	3
GEOSC 1 <sup>*</sup>	3	MATH 220 or 231	2
		MNG 230 <sup>*</sup>	3
	17		16

#### Third Year

Fall	Credits	Spring	Credits
EE 211	3	MNPR 301 <sup>*</sup>	3
GEOSC 201	4	MNG 422	3
MNG 404	2	MNG 331	3
MNG 412 (Take MNG 412 in place of EME 460)	3	MNG 441 <sup>*</sup>	3
EME 303 or CE 360	3	ENGL 202C (GWS) <sup>††</sup>	3
General Education Health and Wellness (GHW)	1.5	General Education Knowledge Domain	3
	16.5		18

#### Fourth Year

Fall	Credits	Spring	Credits
MNG 411	2	MNG 451 (part 2) (Writing across the curriculum) <sup>*</sup>	2
MNG 410	3	General Education Knowledge Domain	3
MNG 451 (Part 1) (Writing across the curriculum) <sup>*</sup>	2	General Education Knowledge Domain	3
GEOSC 470	3	MNG Technical Elective from Approved Department List <sup>2</sup>	3
MNPR 413 <sup>*</sup>	1	General Education Health and Wellness (GHW)	1.5
MNG Technical Elective from Approved Department List <sup>2</sup>	3		
General Education Knowledge Domain	3		
	17		12.5

Total Credits 131

- \* Course requires a grade of C or better for the major
- † Course requires a grade of C or better for General Education
- # Course is an Entrance to Major requirement
- † Course satisfies General Education and degree requirement

#### University Requirements and General Education Notes:

US and IL are abbreviations used to designate courses that satisfy University Requirements (United States and International Cultures).

W, M, X, and Y are the suffixes at the end of a course number used to designate courses that satisfy University Writing Across the Curriculum requirement.

GWS, GQ, GHW, GN, GA, GH, and GS are abbreviations used to identify General Education program courses. General Education includes Foundations (GWS and GQ) and Knowledge Domains (GHW, GN, GA, GH, GS, and Integrative Studies). Foundations courses (GWS and GQ) require a grade of 'C' or better.

Integrative Studies courses are required for the General Education program. N is the suffix at the end of a course number used to designate an Inter-Domain course and Z is the suffix at the end of a course number used to designate a Linked course.

All incoming Schreyer Honors College first-year students at University Park will take ENGL/CAS 137 in the fall semester and ENGL/CAS 138 in the spring semester. These courses carry the GWS designation and replace both ENGL 30 and CAS 100. Each course is 3 credits.

<sup>1</sup> Students who begin their studies at non-UP locations and/or join the college after their first year should substitute CAS 100, CAS 100A, CAS 100B, or CAS 100C (GWS) for EMSC 100S (GWS). EMSC 100S Earth and Mineral Sciences First year Seminar (3) is a required course only for students who begin their studies at UP in the College of Earth and Mineral Sciences.

<sup>2</sup> Mining technical electives may be 6 credits ROTC.

#### Advising Notes:

To enter the major, students need a minimum 2.00 grade point average and third semester standing.

Courses required for the major may be offered fall semester only, spring semester only, or both fall and spring semesters. Consult with your adviser and department to discuss your academic progress and course sequencing.

## Commonwealth Campuses

The course series listed below provides **only one** of the many possible ways to move through this curriculum. The University may make changes in policies, procedures, educational offerings, and requirements at any time. This plan should be used in conjunction with your degree audit (accessible in LionPATH as either an **Academic Requirements** or **What If** report). Please consult with a Penn State academic adviser on a regular basis to develop and refine an academic plan that is appropriate for you.

### First Year

Fall	Credits Spring	Credits
MATH 140 (GQ) <sup>††</sup>	4 MATH 141 (GQ) <sup>††</sup>	4
CHEM 110 (GN) <sup>†</sup>	3 ECON 102 (GS) <sup>†</sup>	3
CHEM 111 (GN) <sup>†</sup>	1 CMPSC 201 or 202	3
ENGL 15, 30, or ESL 15 (GWS) <sup>††</sup>	3 PHYS 211 (GN) <sup>†</sup>	4
EDSGN 100	3 PHIL 103, 106, 107, or 233 (GH) <sup>†</sup>	3
General Education Knowledge Domain	3	
	17	17

### Second Year

Fall	Credits Spring	Credits
PHYS 212 (GN) <sup>†</sup>	4 EMCH 212	3
EMCH 211 (Take EMCH 211 and EMCH 213 in place of EMCH 210)	3 EMCH 213 (Take EMCH 211 and EMCH 213 in place of EMCH 210)	3
MATH 220 or 231	2 EME 301, ME 300, or ME 201	3
CAS 100, 100A, 100B, or 100C (GWS) <sup>††1</sup>	3 ENGL 202C (GWS) <sup>††</sup>	3
General Education Knowledge Domain	3 MATH 250	3
General Education Health and Wellness (GHW)	1.5 MNG 230 (online) <sup>*</sup>	3
	16.5	18

### Third Year

Fall	Credits Spring	Credits
GEOSC 1 <sup>*</sup>	3 MNPR 301 <sup>*</sup>	3
MNG 404	2 MNG 422	3
MNG 412 (Take MNG 412 in place of EME 460)	3 MNG 331	3
EME 303 or CE 360	3 MNG 441 <sup>*</sup>	3
MNG 223 or CE 209	2 GEOSC 201	4
PHYS 213	2	
	15	16

### Fourth Year

Fall	Credits Spring	Credits
MNG 411	2 MNG 451 (part 2) (Writing across the curriculum) <sup>*</sup>	2

MNG 410	3 General Education Knowledge Domain	3
MNG 451 (Part 1) (Writing across the curriculum) <sup>*</sup>	2 General Education Knowledge Domain	3
MNG Technical Elective from Approved Department List <sup>2</sup>	3 MNG Technical Elective from Approved Department List <sup>2</sup>	3
GEOSC 470	3 EE 211	3
STAT 301 (If STAT 301 not available, take STAT 401 instead)	3 General Education Health and Wellness (GHW)	1.5
MNPR 413 <sup>*</sup>	1	
	17	15.5

Total Credits 132

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Integrative Studies courses are required for the General Education program. N is the suffix at the end of a course number used to designate an Inter-Domain course and Z is the suffix at the end of a course number used to designate a Linked course.

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Courses required for the major may be offered fall semester only, spring semester only, or both fall and spring semesters. Consult with your adviser and department to discuss your academic progress and course sequencing.

## Career Paths

The demand for mining engineers routinely exceeds the supply, and our graduates often have a choice of career paths.



## Careers

Companies that actively mine are the largest employer, and seek graduates for production, engineering, and management-trainee positions. Manufacturers of mining equipment employ design and application engineers from our program, as do consulting engineering firms. Government agencies focused on safety, the environment, and research employ many mining engineers. Some are employed in rather unexpected places including banks that finance mining projects and the military. Internships are an important part of the undergraduate program experience, and many of our students complete two or three summer internships with mining companies.

MORE INFORMATION ABOUT POTENTIAL CAREER OPTIONS FOR GRADUATES OF THE MINING ENGINEERING PROGRAM (<http://www.eme.psu.edu/career>)

## Opportunities for Graduate Studies

A relatively small number of mining engineering graduates pursue graduate education; but doing so adds additional career opportunities at government and private research labs, and in academia. Often underappreciated, however, is that broadening and deepening the level of technical skills is valuable in the engineering and production career paths in addition to the obvious value for a career in research. In this regard, developing specialties in a particular facet of mining engineering or expanding into interdisciplinary areas can be particularly rewarding. Some mining engineering graduates pursue graduate degrees in law or business administration.

MORE INFORMATION ABOUT OPPORTUNITIES FOR GRADUATE STUDIES (<http://www.eme.psu.edu/academics/graduate>)

## Professional Resources

- Mining Society Student Chapter (<http://www.eme.psu.edu/academics/student-orgs>)
- International Society of Explosives Engineers Student Chapter (<http://www.eme.psu.edu/academics/student-orgs/isee>)
- International Society of Explosives Engineers Student Chapter (<http://www.eme.psu.edu/academics/student-orgs>)

## Accreditation

The Mining Engineering B.S. program in the John and Willie Leone Family Department of Energy and Mineral Engineering (EME) at Penn State is accredited by the Engineering Accreditation Commission of ABET, <https://www.abet.org/>.

MORE INFORMATION ABOUT ABET ACCREDITATION (<http://www.abet.org>)

## Contact

### University Park

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