

Department of Mining Engineering

Degrees Offered

- Masters of Science, Mining Engineering (M.S.Min.E.)
- Doctor of Philosophy, Mining Engineering (Ph.D.)

Program Objectives

The objective of the master's of science in mining engineering (M.S.Min.E.) program is to equip students to investigate and develop solutions to advanced mining engineering problems. This program provides students the technical knowledge and research experience needed to address the most challenging contemporary issues within a specialized area of study.

Moreover, the objective of the Ph.D. program in mining engineering is to educate students to the highest level of technical and research performance within the minerals profession. Graduates of this program not only possess the requisite technical skills, but they also have the capability to actively contribute to the scholarly body of knowledge through independent research. These graduates pursue impactful careers in industry, government agencies, and academia.

Areas of Research

The expertise of the current faculty members broadly spans many traditional mining sub-disciplines. Active research areas include surface and underground mining, rock mechanics and ground control, mine health and safety, mineral/coal processing, mine pollution control, and mine ventilation.

FACULTY

CHAIR

- John A. Herbst - Ph.D. (University of California, Berkeley)
Mineral Processing, Numerical modeling, Comminution

PROFESSORS

- Keith Heasley - Ph.D. (Colorado School of Mines)
Numerical Modeling, Rock Mechanics
- Vladislav Kecojevic - Ph.D. (University of Belgrade)
Surface Mining, Aggregates Production, Mine Materials Handling Systems

ASSOCIATE PROFESSOR

- Yi Luo - Ph.D. (West Virginia University)
Surface Subsidence, Ventilation
- Brijes Mishra - Ph.D. (West Virginia University)
Rock mechanics, Numerical modeling
- Felicia F. Peng - Ph.D. (West Virginia University)
Coal Preparation, Coal Utilization, Process Control, Plant Design

ASSISTANT PROFESSOR

- Aaron Noble - Ph.D. (Virginia Tech)
Mineral Processing, Flowsheet design, Froth Flotation

RESEARCH ASSISTANT PROFESSOR

- Mark Sindelar - Ph.D. (University of Pittsburgh)
Mine power systems

Admission Requirements

The Masters of science in the mining engineering program admits students who have met the following requirements:

- A grade point average (GPA) of 3.0/4.0 or above from an ABET-accredited B.S.Min.E. program or its equivalent. Additionally, all Ph.D. applicants must have earned an M.S. degree in mining engineering with a GPA of 3.0 or higher. Transfer students must have at least a GPA of 3.0/4.0 for the graduate programs at similar institutions.
- International applicants must submit a GRE score and demonstrate proficiency in communicating English. For applicants whose native language is not English, this requirement may be fulfilled by a TOEFL-pBT test score of 550 or better, or an iBT score of 79, or an IELTS score of 6.5.

- At least three letters of recommendation, one of which must be from the applicant's previous thesis advisor or an academic equivalent. All letters of recommendation should evaluate the student's potential for performing independent, masters or doctoral-level research.

The same review process is used for M.S. and Ph.D. applications. In both cases, the completed application packets are circulated to the graduate faculty. Initial evaluations consider whether:

1. The applicant should or should not be accepted; and
2. The reviewing faculty member is or is not willing to provide support.

If multiple positive responses are produced, the assignment of the potential graduate student is resolved at a meeting of the faculty according to specific needs and interests.

Curriculum in Masters of Science in Mining Engineering

A candidate for the M.S. degree in mining engineering must comply with the rules and regulations as outlined in the WVU Graduate Catalog and the specific requirements of the Statler College and the Mining Engineering Department.

Program Requirements

All M.S. degree candidates are required to perform research and follow a planned program of study. The student's research advisor, in conjunction with the student's Advising and Examining Committee (AEC) will be responsible for determining the plan of study appropriate to the student's needs. The underlying principle of the planned program is to provide the students with the necessary support to complete their degree and prepare them for their career.

Curriculum Requirements

A minimum cumulative GPA of 3.0 is required in all courses

Course Requirements *

A minimum of 60% of course must be from 500 level or above

Select from the following based on degree path 24

Any BIOM, CE, CHE, CHEM, CPE, CS, EE, IENG, IH&S, MAE, MATH, MINE, PNGE, PHYS, SAFM, SENG, or STAT courses 400-799

Thesis Option - 6 hours		
MINE 697	Research (6 hours)	6
Written Research Proposal		
Thesis		
Final Oral or Written Examination		
Total Hours		30

* Students who do not hold a baccalaureate degree in mining engineering are required to take a set of undergraduate mining engineering courses above and beyond the minimum coursework requirements.

Final Examination

M.S. students following the thesis or problem report option must prepare a written research proposal. The proposal must be approved by the student's AEC at least one semester prior to the final oral examination.

All students, regardless of option, are required to pass a final oral or written examination, administered by their AEC, covering the thesis or problem report and/or related course material.

Suggested Plan of Study

The plan below illustrates the Thesis Option. It is important for students to take courses in the order specified as much as possible; all prerequisites and concurrent requirements must be observed. A typical M.S.Min.E degree program that completes degree requirements in two years is as follows.

First Year

Fall	Hours Spring	Hours
Course	3 Course	3
Course	3 Course	3
Course	3 Course	3
9		9

Second Year

Fall	Hours Spring	Hours
Course	3 Course	3
MINE 697	6 MINE 697	6
	9	9

Total credit hours: 36

Curriculum in Doctor of Philosophy – Mining Engineering

A candidate for the Ph.D. degree with a major in mining engineering must comply with the rules and regulations as outlined in the WVU Graduate Catalog and the specific requirements of the Statler College and the Mining Engineering Department.

Program Requirements

The doctor of philosophy degree with a major in mining engineering is administered through the college's interdisciplinary Ph.D. program. The research work for the doctoral dissertation must show a high degree of originality on the part of the student and must constitute an original contribution to the art and science of mining engineering.

All Ph.D. degree candidates are required to perform research and follow a planned program of study. The student's research advisor, in conjunction with the student's Advising and Examining Committee (AEC) will be responsible for determining the plan of study appropriate to the student's needs. The underlying principle of the planned program is to provide the students with the necessary support to complete their degree and prepare them for their career.

Curriculum Requirements

A minimum cumulative GPA of 3.0 is required in all courses

Course Requirements *		
Research		24
MINE 797	Research	
Select from the following based on degree path:		18
Any BIOM, CE, CHE, CHEM, CPE, CS, EE, IENG, IH&S, MAE, MATH, MINE, PNGE, PHYS, SAFM, SENG, or STAT courses 500-799		
Examinations		
Qualifying Exam		
Candidacy Exam		
Final Exam		
Total Hours		42

* Students who do not hold a baccalaureate degree in mining engineering are required to take a set of undergraduate mining engineering courses above and beyond the minimum coursework requirements. A minimum of eighteen hours of coursework and twenty-four hours of independent research beyond an M.S. degree are required.

Examinations

QUALIFYING EXAM

All students must take and pass a written qualifying examination. Normally, the qualifying examination is given no later than one semester after completion of eighteen credit hours toward the doctoral degree. All mining engineering students must pass the written qualifying examination within three semesters since registered in Mining Engineering graduate program. This examination is designed to assess the basic competency of students in the mining engineering field to determine whether or not they have sufficient knowledge to undertake independent research.

CANDIDACY EXAMINATION

In order to be admitted to candidacy, the student must pass a candidacy exam, which is designed to evaluate the student's overall ability to engage in high-level research. The candidacy exam consists of a written qualifying examination and dissertation proposal defense. The proposal must be approved by the student's AEC at least one semester prior to the final oral examination. The written qualifying exam includes material from the eight areas of specialization.

A student who has successfully completed all coursework, passed the qualifying examination, and successfully defended the research proposal is defined as one who is a candidate for the Ph.D. degree.

FINAL EXAMINATION

At the completion of the dissertation research, candidates must prepare a dissertation and pass the final oral examination (defense) administered by their AEC.

In order to complete the Ph.D. requirements, a student must pass a final oral examination on the results embodied in the dissertation. This examination is open to the public and, in order to evaluate critically the student's competency, may include testing on material in related fields, as deemed necessary by the AEC. In addition, since the Ph.D. degree is primarily a research degree that embodies the results of an original research proposal and represents a significant contribution to scientific literature, the student must submit a manuscript on this research to the AEC.

Suggested Plan of Study

It is important for students to take courses in the order specified as much as possible; all prerequisites and concurrent requirements must be observed. A typical doctoral degree program that completes degree requirements in four years is as follows.

First Year

Fall	Hours Spring	Hours
Course	3 Course	3
Course	3 Course	3
MINE 797	3 MINE 797	3
	9	9

Second Year

Fall	Hours Spring	Hours
Course	3 Course	3
MINE 797	6 MINE 797	6
	9	9

Third Year

Fall	Hours Spring	Hours
MINE 797	9 MINE 797	9
	9	9

Fourth Year

Fall	Hours Spring	Hours
MINE 797	9 MINE 797	9
	9	9

Total credit hours: 72

Major Learning Goals

MASTER OF SCIENCE IN MINING ENGINEERING (MSMINE)

Upon graduation, with a Masters of Science degree in Mining Engineering, students will have:

- Ability to investigate and develop solutions to advanced mining engineering problems
- Advanced technical knowledge and research experience needed to address the most challenging contemporary issues within a specialized area of study

DOCTOR OF PHILOSOPHY (PHD)

Upon graduation with a Ph.D. degree from the Statler College of Engineering and Mineral Resources, students will have:

- Ability to initiate research ideas in order to solve specific problems and to write research proposals on these ideas
- Have an expert-level understanding of the advanced principles of their fields of study
- Furthered a novel research idea which has contributed to the state of the art in their specific areas of expertise
- Ability to plan original research projects, to perform laboratory or field based experimental tasks, generate data from those tasks, and draw conclusions based on sound scientific and engineering principles
- Ability to develop innovative research in order to advance the frontiers of knowledge and secure sponsored research
- Ability to write technical articles for dissemination through peer-reviewed, refereed journals or other venues
- Ability to make oral and poster presentations at technical meetings

- Understanding of professional and ethical responsibilities in the practice of their profession to contribute to the well-being of society and to the advancement of their profession
- Demonstrated initiative in research planning and management, including safety and environmental issues
- Technical preparation for and an awareness of the need for life-long learning and continuing education

COURSES

MINE 505. Integrated Mining Systems. 3 Hours.

PR: Graduate standing or consent. Problem-based and integrative learning to solve problems on underground and surface mining systems based on engineering principles.

MINE 588. Advanced Mine Control Systems Engineering. 3 Hours.

PR: MINE 682 with a minimum grade of B- or MINE 382. Specially focused on controls requirements in extraction industries, combining classic control theory with first and second order system response, assessing system stability, selection of appropriate and cost-effective field-level sensors and devices, and overall control system design using programmable logic controllers. Responsible charge managing design-build controls project team.

MINE 593. Special Topics. 1-6 Hours.

A study of contemporary topics selected from recent developments in the field.

MINE 595. Independent Study. 1-6 Hours.

Faculty supervised study of topics not available through regular course offerings.

MINE 611. Advanced Ground Control-Coal Mines. 3 Hours.

PR: MINE 411 or consent. Ground and strata control for underground and surface coal mining, including slope stability and subsidence.

MINE 612. Surface Subsidence Engineering. 3 Hours.

PR: MINE 411. Elements of surface subsidence engineering due to underground mining: theories of surface subsidence, characteristics and prediction of surface movements, and effects of surface movements.

MINE 613. Ground Control Failures. 3 Hours.

PR: MINE 611 or consent. Case studies of ground control failures on coal pillar, roof bolting, roof fall, cutter, floor heave, multiple-seam mining, and longwall mining.

MINE 616. Advanced Rock Mechanics. 3 Hours.

PR: MINE 414 or consent. Testing techniques and interpretation, strength and fracture, classification, anisotropy, friction, jointed rock, fluid pressure, fragmentation, and excavation.

MINE 624. Numerical Analysis in Mineral Engineering. 3 Hours.

PR: Graduate standing or consent. Application of mathematical and numerical methods in metallurgy and mineral processing problems.

MINE 625. Advanced Mineral Processing. 3 Hours.

PR: MINE 326, MINE 425, and MINE 427 or consent. Theory and technology of separation. Triboelectrostatic and magnetic dry ore and coal separation. Engineering and scientific aspects of column flotation of fines in coal and mineral industries.

MINE 627. Advanced Coal Preparation. 3 Hours.

PR: MINE 427 or consent. Coal preparation design and analysis. Fine coal column flotation, agglomeration, and dewatering. Biotechnology and others for HAPs removal. Coking and coal utilization. Instrumentation for process control.

MINE 628. Computation Fluid Flow in Mineral Engineering. 3 Hours.

PR: Graduate standing or consent. Applications of appropriate theories for solving fluid transportation problems in mineral engineering. Newtonian and non-Newtonian slurries and applications to mineral engineering are emphasized.

MINE 629. Mine Wastes Management/Closure. 3 Hours.

PR: Consent. Planning and design to control, detoxify and contain mine openings for mine and mill closure in mineral industry. Regulatory frameworks.

MINE 631. Mine Ventilation Network Analysis. 3 Hours.

PR: MINE 331 and MINE 381 or consent. Theory and computational techniques for mine ventilation network problems with emphasis on computer-aided analysis of complex mine ventilation systems.

MINE 632. Advanced Mine Ventilation. 3 Hours.

PR: MINE 331. Advanced topics in mine atmospheric control including control of methane, dust, humidity, and heat. Also covers leakage characteristics, fan selection, analysis of ventilation networks, and planning of mine ventilation system.

MINE 633. Coal Mine Methane Control. 3 Hours.

PR: Graduate standing or consent. Control of explosive gas emissions in coal mines. Procedures for measurement, mitigation, capture, and utilization of mine-generated gases. Techniques for gas emission forecasting.

MINE 661. Numerical Analysis for Mine Design. 3 Hours.

PR: Graduate standing or consent. An introduction to the formulation and application of boundary-element, finite-difference, and discrete element methods for geomechanical design of mines and geologic structures.

MINE 662. Displacement Discontinuity Modeling in Mining. 3 Hours.

PR: MINE 661 or consent. An in-depth look into the formulation and application of the displacement discontinuity method for modeling stresses and displacements in single and multiple-seam coal mines.

MINE 663. Geomechanical Modeling with Fast Lagrangian Analysis of Continuum. 3 Hours.

PR: MINE 611 or consent. An in-depth study of the application of the finite- difference program, FLAC, for modeling static and dynamic scenarios in mining, geologic and soil structures.

MINE 682. Advanced Mine Power Systems. 3 Hours.

PR: Graduate standing or consent. Advanced study of mine electrical power systems from theory to practice covering the vital aspects that go into planning and designing a mine power system.

MINE 687. Materials Engineering. 3 Hours.

A study of materials engineering fundamentals emphasizing semiconductor, polymer, metal, and ceramic/cementitious material systems. Mechanical and physical properties, theoretical aspects, testing, design criteria, manufacturing, and economics of material systems. Laboratory testing and evaluation. (Equivalent to CE 687, CHE 687, EE 687, IMSE 687, and MAE 687.).

MINE 691A-Z. Advanced Topics. 1-6 Hours.

PR: Consent. Investigation of advanced topics not covered in regularly scheduled courses.

MINE 693A-Z. Special Topics. 1-6 Hours.

A study of contemporary topics selected from recent developments in the field.

MINE 695. Independent Study. 1-6 Hours.

Faculty supervised study of topics not available through regular course offerings.

MINE 697. Research. 1-15 Hours.

PR: Consent. Research activities leading to a thesis, problem report, research paper, or equivalent scholarly project, or a dissertation. (Grading may be S/U.).

MINE 711. Theories of Surface Subsidence. 3 Hours.

PR: MINE 612. Theories of surface subsidence due to underground coal mining including empirical, profile function, theoretical and physical modeling methods, and time factors. (3 hr. lec.).

MINE 712. Theory of Pillar Design. 3 Hours.

PR: MINE 411 and MINE 611. Examination of various theories of pillar design for room and pillar mining and longwall mining including chain pillars, barrier pillars, and bleeder pillars.

MINE 713. Theory of Roof Bolting. 3 Hours.

PR: MINE 611 or consent. Review and discuss various theories of roof bolting. Review select papers representative of recent developments of design of roof bolts and selection of materials.

MINE 716. Theory of Rock Failure. 3 Hours.

PR: MINE 414 or consent. Friction, elasticity, strength of rock, mechanism of brittle failure, factors affecting failure process, theories of failure, fracture propagation in rock, fracture toughness of rock and coal, fluid pressure, size, stress gradient, and time-dependent effects.

MINE 718. Rock Mechanics in Mine Design. 3 Hours.

PR: MINE 411 and MINE 414 or consent. Design process in mining engineering; design approaches for excavations in rock; input parameters for design; empirical, observational, and analytical methods of design; integrated designs. (1 hr. lec., 2 hr. lab.).

MINE 731. Mine Ventilation Network Optimization. 3 Hours.

PR: MINE 631 or consent. Application of mathematical optimization techniques to mine ventilation network problems, including linear and nonlinear optimization for controlled-flow and generalized networks.

MINE 769. Expert Systems in Mining. 3 Hours.

PR: Graduate standing. An overview of expert systems applications in mining, a detailed study of two mining applications, study of shells and their components, and study of a specific shell used to develop a project.

MINE 790. Teaching Practicum. 1-3 Hours.

PR: Consent. Supervised practice in college teaching of mining engineering. Note: This course is intended to insure that graduate assistants are adequately prepared and supervised when they are given college teaching responsibility. It will also present a mechanism for students not on assistantships to gain teaching experience. (Grading may be S/U.).

MINE 791A-Z. Advanced Topics. 1-6 Hours.

PR: Consent. Investigation of advanced topics not covered in regularly scheduled courses.

MINE 792. Directed Study. 1-6 Hours.

Directed study, reading, and/or research.

MINE 793. Special Topics. 1-6 Hours.

A study of contemporary topics selected from recent developments in the field.

MINE 794. Seminar. 1-6 Hours.

Special seminars arranged for advanced graduate students.

MINE 795. Independent Study. 1-9 Hours.

Faculty supervised study of topics not available through regular course offerings.

MINE 796. Graduate Seminar. 1 Hour.

PR: Consent. Each graduate student will present at least one seminar to the assembled faculty and graduate student body of his or her program.

MINE 797. Research. 1-15 Hours.

PR: Consent. Research activities leading to thesis, problem report, research paper or equivalent scholarly project, or a dissertation. (Grading may be S/U.).

MINE 798. Thesis or Dissertation. 1-6 Hours.

PR: Consent. This is an optional course for programs that wish to provide formal supervision during the writing of student reports (698), or dissertations (798). Grading is normal.

MINE 799. Graduate Colloquium. 1-6 Hours.

PR: Consent. For graduate students not seeking coursework credit but who wish to meet residency requirements, use the University's facilities, and participate in its academic and cultural programs. Note: Graduate students who are not actively involved in coursework or research are entitled, through enrollment in their department's 699/799 Graduate Colloquium to consult with graduate faculty, participate in both formal and informal academic activities sponsored by their program, and retain all of the rights and privileges of duly enrolled students. Grading is S/U; colloquium credit may not be counted against credit requirements for masters programs. Registration for one credit of 699/799 graduate colloquium satisfies the University requirement of registration in the semester in which graduation occurs.