Mining and Mineral Resources Engineering

Mining engineers engage in planning, design, development and management of surface and underground mining operations for extraction of the earth’s mineral deposits. The Mining Engineering Program prepares graduates to meet the challenges of the mining industry with emphasis on the coal and aggregate industries.

The missions of the Department are: to provide quality engineers to meet current trained manpower needs for exploration and extraction of regional minerals resources in an environmentally acceptable manner; advance the mining engineering discipline by engaging in basic and applied research, with emphasis on solving regional problems; and to transfer and apply new technical knowledge to enhance the competitive position of the state and national minerals industry.

Program Educational Objectives

Our undergraduate degree in mining engineering prepares our students for careers in or related to the mining industry. Within three to five years of graduation, our students will:

1. Have the ability to practice mining engineering in global, sustainable and societal contexts.
2. Have skills needed for effective communication, teamwork and creative thinking.
3. Have the ability to pursue advanced education and/or lifelong learning to support career development in a broad range of mining related fields.
4. Have the education and background to always act in a safe, professional and ethical manner.

Student Outcomes

Student outcomes describe what students are expected to know and be able to do by the time of graduation. These relate to the skills, knowledge, and behaviors that students acquire as they progress through the program. In order to meet our program educational objectives, we will prepare our students to know the following:

1. The ability to apply knowledge of mathematics, science, and engineering.
2. The ability to design and conduct experiments, as well as to analyze and interpret data.
3. The ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.
4. The ability to function on multi-disciplinary teams.
5. The ability to identify, formulate and solve engineering problems.
6. An understanding of professional and ethical responsibility.
7. The ability to communicate effectively.
8. The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context.
9. A recognition of the need for and an ability to engage in life-long learning.
10. Knowledge of contemporary issues.
11. The ability to use the techniques, skills and modern engineering tools necessary for engineering practice.
Coursework in the program includes such areas as surface and underground mining systems, mine ventilation, ground control and rock mechanics, mineral and coal processing, material handling systems, engineering economics, mine environment, health and safety engineering, probability and statistics applications, and computer-aided mine design. Facilities include modern, well-equipped rock mechanics, mine ventilation, mineral processing, material handling, mine environment, and computer laboratories.

After completing the program, the graduate may work in an engineering or management position for mining industries, environmental companies, construction industries, oil companies, equipment manufacturers, research organizations, or government agencies. The coursework also provides strong preparation for further study at the graduate level. The undergraduate program in mining engineering is accredited by the Engineering Accreditation Commission of ABET, www.abet.org.

### Bachelor of Science Degree in Mining Engineering, College of Engineering

#### Mining Engineering Major

<table>
<thead>
<tr>
<th>Degree Requirements</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>University Core Curriculum Requirements ¹</td>
<td>39</td>
</tr>
<tr>
<td>Requirements for Major in Mining Engineering (9)+87</td>
<td></td>
</tr>
<tr>
<td>Basic Science</td>
<td>(6)+9</td>
</tr>
<tr>
<td>PHYS 205A, PHYS 255A ²</td>
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<tr>
<td>CHEM 200, CHEM 201 ³</td>
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<td>GEOL 220 or GEOL 222, GEOL 302</td>
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<tr>
<td>Mathematics</td>
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<td>MATH 150, MATH 250, MATH 251, MATH 305</td>
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<tr>
<td>MNGE 417</td>
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<tr>
<td>Science/Math Elective ⁴</td>
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<tr>
<td>Required Engineering Courses</td>
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<td>ENGR 250, ENGR 261, ENGR 335, ENGR 350A, ENGR 370A</td>
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<td>ME 102</td>
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<tr>
<td>Required MNGE Courses - MNGE 270, MNGE 310, MNGE 315, MNGE 317, MNGE 320, MNGE 420, MNGE 425, MNGE 430, MNGE 431, MNGE 440, MNGE 455, MNGE 460, MNGE 475</td>
<td>38</td>
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<tr>
<td>Approved Electives</td>
<td>6</td>
</tr>
</tbody>
</table>
Degree Requirements | Credit Hours
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Total | 126

1. Students transferring are required to: (a) have an associate degree in a baccalaureate-oriented program or (b) meet the Core Curriculum requirements for engineering students. See departmental advisor for an approved course.

2. Courses required for the major will apply towards University Core Curriculum.

3. Courses required for the major will apply towards University Core Curriculum.

4. Three hours of a science/math elective and six hours of major electives are required. See departmental advisor for approved courses.

**Mining and Mineral Resources Engineering Courses**

**MNGE270 - Intro to Mining Engineering** 270-3 Introduction to Mining Engineering. Importance of mining to a country’s economy; stages of mining; prospecting and exploration, development and extraction; unit operations of mining; surface mining systems; underground mining methods; novel mining methods; mineral processing; marketing of minerals. Restricted to Engineering students or permission of instructor.

**MNGE292 - Special Topics** 292-1 to 3 Special Topics in Mining Engineering. Course topics will be identified by instructor. Restricted to mining engineering transfer students.

**MNGE310 - Underground Mining** 310-3 Underground Mining. Underground mining access openings; underground mining equipment types and functions; advancing, sinking, and production blast rounds, underground mining methods, planning, and layout considerations. Prerequisite: MNGE 270 or consent of instructor. Pre or Co-requisite: MATH 150 or consent of instructor.

**MNGE315 - Surface Mining** 315-3 Surface Mining. Surface mining methods, equipment, and sequences; surface mining tools; surface mine blast design basics; truck-shovel fleet design, sizing and selection. Prerequisite: MNGE 270 or consent of instructor. Pre or Co-requisite: MATH 150 or consent of instructor.

**MNGE317 - Ore Minerals** 317-1 Ore Minerals. Introduction to the rocks and minerals that are commonly mined including such considerations as typical grade and tonnage relations, an overview of how the minerals and rocks are made into economic products, and the value and use of those products. Class includes basic mineral identification. Prerequisites: MNGE 270, GEOL 220 or GEOL 222 and knowledge of element symbols and formulas from chemistry or similar background with consent of instructor.

**MNGE320 - Mine Surveying Lab** 320-1 Mine Surveying Laboratory. Introduction to surveying; horizontal and vertical angles; using a level; land surveying; analysis of survey data for engineering design. Laboratory. Prerequisite: MATH 109 or MATH 111, or consent of instructor.

**MNGE392 - MNGE Co-op Education** 392-1 to 6 Mining Engineering Cooperative Education. Supervised work experience in industry, government or professional organizations. Students work with on-site supervisor and faculty adviser. Reports are required from the student and the employer. Hours do not count toward degree requirements. Mandatory Pass/Fail. Restricted to sophomore standing.

**MNGE401 - Mining Env Impacts & Permits** 401-1 Mining Environmental Impacts and Permits. Socio-economic impacts of mining industry. Analyzing the markets for coal and its products. Mining operations and related environmental impacts. Mining permits. Prerequisite: MNGE 270 or consent of instructor.

**MNGE405 - Field Trip** 405-1 Field Trip. Visit several mining operations and prepare a report. Not for graduate credit. Prerequisite: MNGE 270.

of engineering systems and optimization. Project management techniques and system simulation. Prerequisite: MATH 150.

**MNGE420 - Mineral Processing** 420-4 Mineral and Coal Processing. Principles of processing minerals, aggregates and coal, including unit operations of comminution, classification, solid-solid separation, dewatering and tailings disposal. Laboratory investigations of the fundamental principles governing unit operations including size reduction, mineral liberation, classification, mineral recovery, and dewatering. Laboratory. Prerequisite: MNGE 270, CHEM 200, PHYS 205A, MATH 250; Concurrent enrollment in or completion of ENGR 370A or 370B, or consent of instructor.

**MNGE421 - Processing Plant Design** 421-3 Mineral Processing Plant Design. Engineering design of unit operations used for minerals, aggregates and coal processing including crushing, grinding, industrial screening, classification, gravity separation, flotation and dewatering. Overall plant performance optimization and flow sheet design. Prerequisite: MNGE 417 or concurrent enrollment and MNGE 420. Special approval needed from the instructor.


**MNGE430 - Econ of Mineral Resources** 430-3 Economics of Mineral Resources. Investment decision making criteria; economic viability of mining projects, financing mining projects; sensitivity and risk analyses. Prerequisite: MNGE 270, or consent of instructor.

**MNGE431 - Rock Mechanics** 431-4 Rock Mechanics: Principles and Design. Analysis of stress and strain, elementary elasticity, stress distribution around openings, engineering properties of rocks, artificial support and reinforcement, slope stability. Laboratory. Prerequisite: ENGR 350A or 350B. Special approval needed from the instructor for graduate students and non-majors.

**MNGE435 - Operations Research** 435-3 Application of Operations Research to Mining. Mine systems analysis, operations research and statistics in decision making, production engineering, optimization, linear programming, simulation. Prerequisite: MNGE 270, knowledge of linear algebra, or consent of instructor.

**MNGE440 - Material Handling Systems** 440-3 Material Handling Systems. Analysis and design of material handling systems such as belt conveying, hoisting and pumping. Mine power systems design. AC and DC motor applications. Material handling systems economics. Prerequisite: MNGE 310 and MNGE 315 with minimum grades of C, or consent of instructor.

**MNGE450 - Industrial Minerals** 450-3 Industrial Minerals. Mining, Processing and Utilization aspects of key industrial minerals with special emphasis on the aggregates industry. Prerequisite: MNGE 270, 420 or consent of instructor.

**MNGE455 - Mine Environment, Safety** 455-3 Mine Environment, Health and Safety Engineering. Analysis of mine environmental impacts and their mitigation, safety problems and rules and regulations, hazards and accidents. Sealing and recovery of mines. Design of mine emergency plans, safety methods, and health hazard control plans. Acid mine drainage, minerals waste disposal environmental remediation. Prerequisite: MNGE 310, 315, consent of instructor. Mining industrial experience will be accepted in lieu of prerequisites.

**MNGE460 - Senior Design** 460-3 Senior Design. Projects in planning and design of surface and underground mining systems. Evaluate and design mining subsystems; integrate subsystems and procedures into a preliminary mine design; and optimize operations from exploration to closure. Two lectures and two two-hour laboratories per week. Prerequisite: MNGE 420, 425, 431, 440, or consent of instructor.

**MNGE475 - Excavation Design** 475-3 Analysis and Design of Mine Excavations. Rock classification; design of shafts, slopes, tunnels, and underground chambers; support requirements; design of slopes; design of mining systems from ground control point of view; design of impoundments. Prerequisite:
MNGE 310, 315, and 431. Special approval needed from the instructor for graduate students and non-majors.

**MNGE492 - Special Probs in Mnge** 492-1 to 5 Special Problems in Mining Engineering. Topics and problems selected either by the instructor or the student with the approval of the instructor. Five hours maximum course credit. Not for graduate credit. Restricted to senior standing. Special approval needed from the instructor.

**MNGE511 - Advanced Ground Control** 511-3 Advanced Ground Control. Ground control in viscoelastic, plastic, and jointed rocks, artificial rock stabilization, in-situ stresses, minimizing structural damage due to subsidence, bumps and rock bursts. Prerequisite: MNGE 431 or consent of instructor.

**MNGE519 - Adv Mine Envirn/Pollutn Contrl** 519-2 Advanced Mine Environment and Pollution Control. Study of the design of coal dust control plan; methane control. Design of mine illumination system, noise control and water pollution control. Prerequisite: MNGE 310 and MNGE 315.

**MNGE521 - Mineral Proc Desn Simulation** 521-3 Mineral Processing Design and Simulation. Mineral processing related unit process design, modeling and simulation of selected processes, complete plant flowsheet development and optimization of plant performance; modeling and simulation experience through multiple class projects. Prerequisite: MNGE 420, MNGE 421 or concurrent enrollment or consent of instructor.


**MNGE535 - Rock Fragmentation** 535-3 Rock Fragmentation. Principles of rock fragmentation, cutting and drilling, mechanics of rock penetration, drillability indices, use of explosives in rock fragmentation, design of blasting patterns in surface and underground mines, prevention of airblast and noise due to blasting, chemical fragmentation. Prerequisite: MNGE 431 or consent of instructor.

**MNGE540 - Productn Engr Coal Mines** 540-3 Production Engineering in Coal Mines. Operations analyses of production cycles in surface and underground coal mining systems, mine planning and design using computer models, computer simulation, economic analysis of mining systems. Prerequisite: MNGE 435 or consent of instructor.

**MNGE545 - Excavation Design** 545-3 The Design, Analysis, Monitoring and Support of Underground Excavations. Tunneling thru consolidated and unconsolidated material including cut and cover, drilling and blasting and rapid excavation techniques. Classification and hydrogeologic systems. The design of tunnel liners and support and instrumentation and modeling. Mining majors need MNGE 431 or equivalent or consent of instructor. Some knowledge of rock mechanics, strength of materials and analysis is needed for non-majors. Student cannot get credit for MNGE 475 and MNGE 545, graduate students only.

**MNGE550 - Industrial Minerals** 550-3 Industrial Minerals. (Same as MNGE 450) Processing of key industrial minerals including Kaolin Clay, Talc, Mica, Carbonates and Aggregates. Ultra fine grinding and surface property based separation processes. Mining and Utilization aspects. Prerequisite: MNGE 270, MNGE 420, MNGE 421 or consent of instructor.

**MNGE580 - Seminar** 580-1 Seminar. Research presentations and discussion with peer audience.

**MNGE592 - Special Investigations** 592-1 to 5 Special Investigations. Self based study under the supervision of a Mining Engineering Department Faculty.

**MNGE599 - Thesis** 599-1 to 6 Thesis.

**MNGE601 - Continuing Enrollment** 601-1 per semester Continuing Enrollment. For those graduate students who have not finished their degree programs and who are in the process of working on their dissertation, thesis, or research paper. The student must have completed a minimum of 24 hours of dissertation research, or the minimum thesis, or research hours before being eligible to register for this course. Concurrent enrollment in any other course is not permitted. Graded S/U or DEF only.
Mining and Mineral Resources Engineering Faculty

Chugh, Yoginder P., Professor, Emeritus, Ph.D., Pennsylvania State University, 1971.
Harpalani, Satya, Professor, Ph.D., University of California, Berkeley, 1985.
Mohanty, Manoj, Professor, Ph.D., Southern Illinois University, 1997.
Paul, Bradley C., Associate Professor, Emeritus, Ph.D., University of Utah-Salt Lake, 1989.
Sinha, Atmesh K., Professor, Emeritus, Emeritus, Ph.D., University of Sheffield, 1963.
Spearing, Anthony, Associate Professor, Emeritus, Ph.D., University of Silesia, Poland, 1993.

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Catalog Year Statement:
Students starting their collegiate training during the period of time covered by this catalog (see bottom of this page) are subject to the curricular requirements as specified herein. The requirements herein will extend for a seven calendar-year period from the date of entry for baccalaureate programs and three years for associate programs. Should the University change the course requirements contained herein subsequently, students are assured that necessary adjustments will be made so that no additional time is required of them.