

MINING ENGINEERING

<http://www.engr.siu.edu/mining>
mining@siu.edu

COLLEGE OF ENGINEERING

Chugh, Yoginder P., Professor, Ph.D., Pennsylvania State University, 1971; 1977. Coal combustion byproduct utilization and management, rock mechanics and ground control.

Harpalani, Satya, Professor and *Chair*, Ph.D., University of California, Berkeley, 1985; 2002. Mine ventilation, coal bed methane reservoir engineering, in situ mining, and carbon dioxide sequestration.

Kroeger, Bane, Assistant Professor, Ph.D., University of Alaska, 1997; 1999. Geological engineering, slope stability, geomechanical engineering.

Mohanty, Manoj, Assistant Professor, Ph.D., Southern Illinois University Carbondale, 1997; 2000.

Coal and mineral processing, experimental design and statistical analysis.

Paul, Bradley, Associate Professor, Ph.D., University of Utah, 1989; 1990. Underground mining systems and solution mining, minerals processing, hard rock and industrial minerals, geostatistics, mine environmental studies.

Sevim, Hasan, Professor, D.E.S., Columbia University, 1984; 1984. Production scheduling, materials handling, mine economics.

Sinha, Atmesh K., Professor, *Emeritus*, Ph.D., University of Sheffield, England, 1963; 1975

Master of Science in Mining Engineering

Graduate work leading to the Master of Science degree in mining engineering is offered by the College of Engineering. The program is designed to provide advanced study in areas such as rock mechanics and ground control, geological engineering, mineral and coal processing, surface and underground mining systems performance optimization, innovative mining systems, surface mine reclamation, in-situ mining, mine environment and ventilation, coal bed methane reservoir engineering, carbon dioxide sequestration, and coal combustion byproduct utilization and management.

Admission

Students seeking admission to the graduate program in mining engineering must meet the admission standards set by the Graduate School and have a bachelor's degree in engineering or its equivalent. A student whose undergraduate training is deficient may be required to take coursework without graduate credit.

A non-refundable application fee of \$20.00 must be submitted with the application. Attach your check or money order, payable to Southern Illinois University, to the top of the application form. Do not send cash. Only checks or money orders payable to United States banks will be accepted.

Requirements

A graduate student in mining engineering is required to develop a program of study with a graduate adviser and a graduate committee. Each student majoring in mining engineering may, with the approval of the graduate committee, also take courses in other branches of engineering or in areas of science and business.

For a student who wishes to complete the requirements of the master's degree with a thesis, a minimum of thirty semester hours of acceptable graduate credit is required. Of this total, eighteen semester hours must be earned in the mining engineering department. Each candidate is also required to pass a comprehensive oral examination covering all of the student's graduate work including thesis.

If a student prefers the non-thesis option, a minimum of 36 semester hours of acceptable graduate credit is required. The student is expected to take at least 21 semester hours within mining engineering including no more than 3 semester hours of the appropriate 592 course to be devoted to the preparation of a research paper. In addition, each candidate is required to pass a written comprehensive examination and an oral examination on the research paper.

If a student with a mining engineering background pursues a master's degree with double major, he or she will be required to take a minimum of 18 credits with thesis option and 22 credits with non-thesis option in mining engineering and 60% of the total credit requirements of the other department. For a student with a background in the related fields such as minerals engineering, geological engineering etc., the minimum credit requirement in the mining department will be 24 credits with thesis option and 28 credits with non-thesis option. Additional deficiency courses will be prescribed for students with a background in non-related fields.

Each student will select a minimum of three graduate faculty members to serve as a graduate committee, subject to the approval of the chair of the Department of MMRE. It is strongly suggested that at least one member is from another department within or outside the College of Engineering. The committee will:

1. approve the student's program of study,
2. approve the student's research topic,
3. approve the completed research paper or thesis, and
4. administer and approve the written, or oral, comprehensive examination.

Teaching or research assistantships and fellowships are available for qualified applicants. Additional information about the program, courses, assistantships, and fellowships may be obtained from the College of Engineering or the Department of Mining and Mineral Resources Engineering.

Courses (MNGE)

400-3 Principles of 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.

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: 400 or consent of instructor.

409-2 Underground Exploitation Systems I. Study of mineral deposits evaluation. Underground mining methods for coal and non-coal deposits. Design of mine production and its ancillary systems and subsystems. Prerequisite: 400 and Geology 220. Consent of instructor for graduate students and non-majors.

410-3 Underground Exploitation Systems II. Underground mining access openings; underground mining equipment types and functions; advancing, sinking, and production blast rounds; underground mining methods, planning, and layout considerations. Prerequisite: 270 consent of instructor.

411-2 Mine Machinery. Analysis and design of underground and surface mining machinery. Equipment and parts selection. System development. Preventive maintenance. Prerequisite: 410.

413-3 Mine and Industrial Power Systems. Electric circuits, transformers, motors and their industrial applications. Electrical power distribution; systems design and components selections. Pneumatic and hydraulic power principles. Prerequisite: Physics 205 and Mathematics 250.

414-2 Surface Exploitation Systems I. Surface mining methods and equipment. Economics of stripping ratio, cut-off grade, and equipment selection. Surface blast design basics. Prerequisite: 400, Civil Engineering 263 or Mining Engineering 320, Mathematics 251, Engineering 361, consent of instructor for graduate students and non-majors.

415-3 Surface Exploitation Systems II. (Same as Mining Engineering 315) Surface mining methods, equipment, and sequences; surface mine planning tools; surface mine blast design basics; truck-shovel fleet design, sizing, and selection. Prerequisite: 270 or consent of instructor.

417-2 Applied Probability and Statistics for Engineers. Probability and statistics concepts, analysis of engineering experimental data. Fitting experimental data to distribution functions. Regression analysis. Quality control in production systems. Reliability in engineering processes. Stochastic simulation of engineering systems. Prerequisite: Mathematics 250 or consent of instructor.

418-3 Mining of Ore Deposits. Analysis, planning and design of surface hard rock mines and underground mining system. Analysis of mining and equipment costs. Prerequisite: 400, Geology 419. Consent of instructor for graduate students and non-majors.

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: 270, Chemistry 200, Physics 205a, Mathematics 250, Civil Engineering 370 or concurrent enrollment. Consent of instructor for graduate students and non-majors.

425-4 Mine Ventilation Systems Analysis and Design. Thermodynamic principles in mine ventilation. Study of the theories and practice of natural and forced mine ventilation. Fan and mine characteristics. Ventilation network analysis. Mine ventilation design and problem analysis. Laboratory. Prerequisite: 310, Civil Engineering 370, consent of instructor for graduate students and non-majors.

430-3 Economics of Mineral Resources. Economics of mineral resources. Investment decision making criteria; economic viability of mining projects, financing mining projects; sensitivity and risk analyses. Prerequisite: 400, Engineering 361, or consent of instructor.

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: Civil Engineering 350, consent of instructor for graduate students and non-majors.

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: 270, knowledge of linear algebra, or consent of instructor.

440-4 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: 310, 315, consent of instructor for graduate students and non-majors.

445-3 Mine Equipment Maintenance Engineering. Mechanical, hydraulic and electrical systems in mining equipment. Equipment maintenance problems in mines and minerals processing facilities. Cost of lost production. Cost centers and identification of high cost problem areas in mining operations. Principles, design and development of maintenance systems. Maintenance organization, responsibility, and scheduling. Prerequisite: 409, 414. Consent of instructor for graduate students and non-majors.

450-3 Industrial Minerals. Processing of key industrial minerals with special emphasis on the aggregates industry. Mining and utilization aspects. Prerequisite: 270 or consent of instructor.

455-2 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 mine. Design of mine emergency plans, safety methods, and health hazard control plans. Acid mine drainage, minerals waste disposal environmental remediation. Prerequisite: 310, 315, consent of instructor for graduate students and non-majors.

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: 310, 315, 420, 425, 431, or consent of instructor.

470-3 Experimental Methods in Rock Mechanics. Supplement theoretical knowledge gained in 431 with laboratory experiments. Physical property tests for specific gravity, moisture, density porosity of rocks. Unconfined and confined compressive strength, tensile strength, shear strength, photoelasticity, static and dynamic strain measurement systems, field instrumentation techniques. Laboratory. Prerequisite: 431.

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 underground mining systems from ground control point of view; design of impoundments. Prerequisite: 310, 315, and 431, consent of instructor for graduate students and non-majors.

480-3 Rock Fragmentation Systems. Principles of rock fragmentation. Drilling and mechanics of rock penetration, drillability indices. Chemistry of explosives. Design of blast patterns in surface and underground mines and quarries, prevention of air blast, vibration and noise. Prerequisite: 415. Consent of instructor for graduate students and non-majors.

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: 431 or consent of instructor.

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: 410, 415.

530-3 Mine Management. Study of basic management principles, labor relations, and coal wage agreement. Costing methods and cost control. Operations organization and performance analysis. Prerequisite: consent of instructor.

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: 415, 431 or consent of instructor.

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: 435 or consent of instructor.

545-3 Tunnelling. Tunnelling through consolidated and unconsolidated geologic materials—cut and cover, drilling and blasting, and rapid excavation tunnelling techniques. Classification systems for geologic materials, hydrological investigations, tunnel linings—types, requirements and their design. Instrumentation. Prerequisite: 431 or equivalent, or consent of instructor.

550-3 Industrial Minerals. 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: 420, 421.

580-1 to 2 Seminar. Collective and/or individual studies in coal extraction or utilization.

592-1 to 5 Special Investigations. Special studies of coal extraction or utilization problems.

599-1 to 6 Thesis.

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.