

Mining Engineering

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COLLEGE OF ENGINEERING

Graduate Faculty:

Chugh, Yoginder P., Professor, *Emeritus*, Ph.D., Pennsylvania State University, 1971; 1977. Coal combustion byproduct utilization and management, rock mechanics, ground control, coal mining dust control and production engineering in coal mines.

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

Mohanty, Manoj, Professor, Ph.D., Southern Illinois University Carbondale, 1997; 2000. Coal and mineral processing, experimental design and statistical analysis.

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

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

Spearing, A.J.S. (Sam), Associate Professor, *Emeritus*, Ph.D., Technical University of Silesia, 1993; 2007. Mine design, rock mechanics, backfill, strata control and risk assessment.

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, mine design, mineral and coal processing, surface and underground mining systems performance optimization, innovative mining systems, surface mine reclamation, in-situ mining, mine environment and ventilation, coalbed methane reservoir engineering, carbon dioxide sequestration, dust control, 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.

This program requires a nonrefundable \$65 application fee that must be submitted with the application for Admissions to Graduate Study in Mining Engineering. Applicants must pay this fee by credit card.

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. A minimum of 15 hours must be earned in courses numbered 500 or above.

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 percent of the total credit requirements of the other department. For a student without 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. At least two of the committee members must be from the mining engineering department. 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. Assistantship and fellowship support is limited to two years in line with the Department's expectations of student's time to graduate. An extension of one semester is approved only under exceptional circumstances (eg: equipment failures). 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)

MNGE 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.

MNGE 417-3 Statistics, Probability, and Modeling. Basic concepts of probability and statistics, analysis of engineering data, fitting data to distribution functions. Modeling of engineering systems and optimization. Project management techniques and system simulation. Prerequisite: MATH 150.

MNGE 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; Concurrent enrollment in or completion of ENGR 370A or 370B, or consent of instructor.

MNGE 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.

MNGE 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. Prerequisites: MNGE 320, ENGR 370A or 370B, or consent of instructor.

MNGE 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.

MNGE 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.

MNGE 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.

MNGE 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 or 315 with minimum grades of C, or consent of instructor.

MNGE 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.

MNGE 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.

MNGE 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.

MNGE 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.

MNGE 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.

MNGE 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.

MNGE 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.

MNGE 530-3 Mine Management. Concepts of probability and statistics, analysis of engineering data, fitting data to distribution function. Modeling of engineering systems and optimization using linear programming, project management principles and system simulation.

MNGE 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.

MNGE 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.

MNGE 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.

MNGE 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.

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

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

MNGE 599-1 to 6 Thesis. MNGE 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.