

MNG

Mining Engineering

**MNG 101 INTRODUCTION TO MINING ENGINEERING. (1)**

Orientation to the mining engineering profession; introduction to key mining engineering activities and functions; mining methods and equipment; health and safety subsystems.

**MNG 191 MINE GRAPHICS. (1)**

This course is designed to provide students an understanding of CAD core functionality and features so that they can create, edit, and organize their engineering drawings. It covers essential CAD commands and functions, including coordinate systems, drawing tools, layer management, dimensioning, undoing and altering, moving and duplicating, arrays, blocks, viewports, file maintenance, measurement and calculations, plotting and printing. The course emphasizes hands-on experience with CAD software and practical applications in mining and processing applications.

**MNG 201 MINING ENGINEERING FUNDAMENTALS. (3)**

Introduction to the fundamentals of mining engineering and the profession. Prospecting and exploration concepts introduced including ore reserve estimation techniques. Underground and surface mining methods will be studied with emphasis to applications to given deposit types and spatial constraints. General mine plan, sequence of development and cycle of operations for each method evaluated along with required auxiliary operations and equipment.

**MNG 211 MINE SURVEYING. (2)**

Surveying as applied to mining engineering, including the use and care of surveying instruments, measurement of horizontal and vertical distances, angles and direction, collection of ground and underground data for the design and layout of surface and underground mineral workings; and some aspects of the precise determination of position and direction for survey control. Prereq: MNG 101 or EGR 101 and MA 113 or consent of instructor.

**MNG 264 MINING METHODS. (3)**

A study of the principal underground and surface mining methods practiced in coal and hard rock mines; method classification; support and equipment requirements; general mine planning; sequence of development, cycle of operations, and method application and variation. Prereq: MNG 101 or EGR 101 or consent of instructor.

**MNG 291 ELEMENTS OF MINE DESIGN. (3)**

Practical knowledge of computational tools used in mine design projects for both underground and surface mining, including a programming language and geology/mining modeling software. Geological and mining engineering modeling through the manipulation of software packages commonly used by mining engineers. Projects will cover the areas of surveying, geology, economics and mining. Prereq: MNG 191, MNG 201, or consent of instructor.

**\*MNG 301 MINERALS PROCESSING. (3)**

Principles and practices of mineral processing with emphasis on state-of-the-art separation technologies. Mineral deposits, sampling theory, slurry calculation, and particle motion in fluid streams. Unit operations for processing particulate materials. Crushing and grinding, screening, gravity separation, magnetic and electrostatic separation, froth flotation, dewatering and clarification. Flowsheets, process selection and plant performance evaluation. Laboratory component will reinforce lecture topics on unit processes described above. Prereq: CHE 105, MA 114, PHY 231.

**MNG 302 MINERALS PROCESSING LABORATORY. (1)**

Application of the principles studied in MNG 301. Laboratory, two hours. Prereq or concur: MNG 301.

**MNG 303 DEFORMABLE SOLIDS LABORATORY. (1)**

Experimental studies of the mechanical properties of materials and structural elements. Laboratory, four hours per week for three-fourths of the semester. Prereq or concur: EM 302.

**MNG 311 ELECTRICAL CIRCUITS AND MINING MACHINERY. (3)**

A study of dc and ac electrical circuits, single-phase and three-phase circuits, transformers, and ac and dc rotating machinery used in the mining industry. Prereq: MA 114, PHY 232.

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- MNG 322 MINE SAFETY AND HEALTH MANAGEMENT AND PROCESSES. (2)**  
History and overview of mine health and safety; effective health and safety management systems; building a health and safety culture; hazard anticipation and identification, risk management and hazard control; Federal processes for health and safety system management; mine safety and health resources; mine laws, including safety regulations and interpretations for mining engineers and supervisors; and contemporary issues in mine safety. Prereq: MNG 101 or EGR 101; concur: MNG 264.
- MNG 331 EXPLOSIVES AND BLASTING. (2)**  
Drilling and drill performance, types and properties of commercial explosives, initiation and priming, explosives selection, blast design, explosives applications, environmental effects, and safety and regulatory compliance. Prereq: MNG 264 or consent of instructor.
- MNG 332 MINE PLANT MACHINERY. (3)**  
Theory and practice of mine haulage, hoisting, and drainage and pumping. Application of engineering principles to the analysis and selection of materials handling mediums for the minerals industry. Prereq: MNG 264, PHY 231; concur: EM 221 and ME 330 or CME 330.
- MNG 335 INTRODUCTION TO MINE SYSTEMS ANALYSIS. (3)**  
An introduction to probability, statistics, and statistical inferential reasoning. Probability distributions for discrete and continuous random variables; descriptive statistics and claims arising from them; construction and evaluation of claims arising from formal statistical inference conveyed in confidence intervals and hypothesis tests; analysis of variance; information literacy for statistical inferential reasoning. The course emphasizes mining applications. Prereq: MA 113, or equivalent quantitative foundations course, and MNG 201, or consent of instructor.
- MNG 341 MINE VENTILATION. (3)**  
Hazards of dust and gaseous contamination of mine atmosphere, air dilution requirements, flow distribution in mine network, computer analysis of the ventilation network, natural ventilation and fans. Lecture, two hours; laboratory, three hours. Prereq: Engineering standing and prerequisite or concurrent ME 330.
- MNG 351 UNDERGROUND MINE DESIGN. (3)**  
Principles of underground excavations designs related to metallic, coal and industrial mineral deposits including underground mine layouts, stability of the underground excavations, material handling and drainage control. Underground mine planning and scheduling, equipment selection, and cost estimation. Prereq: MNG 211, MNG 291, MNG 331, Engineering Standing; or consent of instructor.
- MNG 371 PROFESSIONAL DEVELOPMENT OF MINING ENGINEERS. (3)**  
Development of professional skills important to the practice of mining engineering. Topics include written and oral communication skills, understanding ethical responsibility and appropriate ethical conduct, real world problem formulation and solution skills, exercise of abilities important to lifelong learning, knowledge of contemporary issues important to mining engineering. Prereq: Engineering standing. WRD 110/CIS 110 and WRD 111/CIS 111 or WRD 112 or CIS 112. This course is a Graduation Composition and Communication Requirement (GCCR) course in certain programs, and hence is not likely to be eligible for automatic transfer credit to UK.
- MNG 395 INDEPENDENT WORK IN MINING ENGINEERING. (1-6)**  
Individual work on some selected problem in the field of mining engineering. May be repeated for a maximum of six credits. Prereq: Consent of department chairperson and the instructor, engineering standing.
- MNG 431 MINING ENGINEERING ECONOMICS. (2)**  
Engineering economics including discounted cash flow, opportunity cost of capital, cost (incremental, sunk, etc.), net present value and rate of return, and uncertainty; topics in mineral economics. Prereq: Engineering standing.
- \*MNG 435 MINE SYSTEMS ENGINEERING AND ECONOMICS. (3)**  
Mineral-project investment decisions based on the time value of money with tax considerations. And project scheduling using the critical path method (CPM) and project evaluation and review technique (PERT). Prereq: Engineering Standing.
- MNG 463 SURFACE MINE DESIGN. (3)**  
Principles of surface excavations designs related to quarries and mines; including orebody description, pit layouts and excess spoil disposal areas, stability of the slopes, material handling and surface drainage control. Surface mine planning and scheduling, equipment selection, cost estimating, optimization. Prereq: MNG 211, MNG 291, MNG 331, Engineering Standing.

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**MNG 511 MINE POWER SYSTEM DESIGN. (3)**

A study of mine power distribution systems, major power system components, and techniques of power system analysis. Topics include per-unit analysis; symmetrical component analysis; grounding, including ground-bed design, ground-resistor sizing, and ground wire monitoring; cable and transformer sizing; and load-flow analysis. Course may not be used to satisfy degree requirements in electrical engineering if credit is earned in EE 538. Prereq: EE 305 or equivalent and engineering standing.

**#MNG 520 INDUSTRIAL AUTOMATION AND CONTROL. (3)**

Automation techniques for controlling equipment and processes, including applications of sensors, transducers, motor starters, variable-frequency motor drives, linear actuators, and proportional hydraulic valves. Ladder logic programming of programmable automation controllers (PACs) and programming human-machine interface (HMI) touch-screen panels. Prereq: Engineering standing or permission of the instructor. (Same as MFS 520.)

**MNG 531 ADVANCED BLAST DESIGN AND TECHNOLOGY. (3)**

Advanced theory and application of explosives in excavation; detailed underground blast design; specialized blasting including blast casting, construction and pre-splitting. Bulk systems for blasting, electronic detonators, and introduction to demolition blasting. Introduction to blasting research. Examination of field applications. Prereq: MNG 331, engineering standing.

**MNG 535 ENVIRONMENTAL CONTROL SYSTEM DESIGN AND RECLAMATION. (3)**

Introduction to the principles of sustainable mine planning with a focus on environmental control system design, reclamation and restoration design, and environmental monitoring systems. Topics will include culvert and diversion design, hydrologic inputs, catchment delineation and routing, sedimentologic inputs, erosion control and best management practice selection, sediment pond design, design of silt fences, grass filters, and sediment ditches, weep berm and vegetated filter strip design, reforestation, grassland/wildlife establishment, stream restoration, wetlands/vernal ponds, environmental monitoring system design, and community integration. Prereq: MNG 291, MNG 463, and engineering standing or consent of instructor. (Same as BAE 535.)

**MNG 541 COMPUTER DESIGN OF MINE VENTILATION SYSTEMS. (3)**

Computer methods applied to the design and analysis of mine ventilation networks; flow distribution, location and size of regulators and fans; evaluation of existing ventilation systems and application of correction methods to improve effectiveness of ventilation system. Prereq: MNG 341 with a C or higher.

**MNG 551 ROCK MECHANICS. (4)**

Determination of the physical properties of rocks, rock mass classification, stress around mine openings, strain and displacement of the rock mass, rock reinforcement and support, stress interaction and subsidence, strata control. Lecture, three hours; laboratory, three hours per week. Prereq: EM 302, MNG 303, GLY 220, and engineering standing.

**MNG 552 GROUND CONTROL SOFTWARE AND ANALYSIS. (3)**

Evaluation and design of ground control plans for various mining conditions through the use of several computer programs with an emphasis placed on sedimentary tabular deposits. Variables including pillar stress, pillar strength, convergence, and others are investigated. Prereq: MNG 551 – Rock Mechanics or consent of instructor.

**#MNG 555 ADVANCED GEOMECHANICS I. (3)**

3D state of stress and strain, stress redistribution around mine openings, tunnels, wellbores, intact rock and rock mass properties, rock mass failure criteria, role of discontinuities and failure along discontinuities, rock reinforcement and support. Prereq: MNG 551 and engineering standing.

**MNG 561 MINE CONSTRUCTION ENGINEERING I. (3)**

Development of underground capital openings (shafts, chambers, tunnels, and drifts) in mines. Design and construction under normal conditions. Organization and management of construction operations. Prereq: MNG 551.

**MNG 575 COAL PREPARATION DESIGN. (3)**

Design a coal preparation plant by integrating unit operations preceded by certain back-up laboratory experiments. Cost sensitivity analysis of competing design schemes will be determined on a selected coal. Lecture: two hours; laboratory: three hours per week. Prereq: MNG 301 or equivalent, engineering standing.

**MNG 580 MINERAL PROCESSING PLANT DESIGN. (3)**

Design of mineral processing plants including the associated unit operations; flowsheet development, unit selection, sizing and number, water/mass flow balancing. Prereq: MNG 301, 302; engineering standing.

**#MNG 585 APPLIED SURFACE CHEMISTRY. (3)**

Upon completion of this course, students will have an understanding of surface characterization techniques, adsorption principles and measurement, colloidal stability, electrokinetic behavior, surface energy and hydrophobicity/hydrophilicity. The course will focus on the application of these fundamental principles to mineral processing unit operations but will consider other areas of application as well. Prereq: CHE 105, MA 114, PHY 231, MNG 301 and engineering standing or consent of instructor.

**MNG 591 MINE DESIGN PROJECT I. (1)**

First course of a two-part capstone design project. Emphasis is on ore reserve evaluation, development of a preliminary mine plan, design of auxiliary processes, teamwork, and oral and written communication. Minable reserves will be quantified and quality distribution assessed. An appropriate mining technique will be identified and implemented into a proposed mine design. Laboratory, three hours per week. Prereq: MNG 211, MNG 291, MNG 463, MNG 351, and engineering standing.

**MNG 592 MINE DESIGN PROJECT II. (3)**

Students will undertake a major design project such as the overall design of a mining system, including design of major components of the system and economic evaluation. Students will write reports documenting this design, which will also be presented orally before a group of peers and invited experts. Prereq: MNG 332, MNG 341, MNG 551, MNG 591, and engineering standing.

**\*MNG 599 TOPIC IN MINING ENGINEERING. (3)**

A detailed investigation of a topic of current significance in mining engineering. May be repeated to a maximum of nine credits, but only three credits can be earned under the same title. A particular topic may be offered at most twice under the MNG 599 number. Prereq: Engineering standing and consent of instructor.

**MNG 611 MINE POWER SYSTEM PROTECTION. (3)**

A study of components and methods for providing protection to mine electrical systems. Review topics include power distribution arrangements, per-unit system, and symmetrical components. Course topics include sources of transients and faults, protective equipment, phase Overcurrent relaying, and ground fault protection. Prereq: MNG 511.

**MNG 621 INSTRUMENTATION FOR BLASTING AND BLAST MITIGATION. (3)**

In depth coverage of instrumentation utilized for commercial/mine blast analysis as well as instrumentation used in blast mitigation testing. The course includes hands on operation of advanced instrumentation systems in a laboratory setting. Prereq: MNG 331 or MNG 531.

**MNG 641 ADVANCED MINE VENTILATION. (3)**

Planning, designing and redesigning the ventilation systems using computers; data acquisition (ventilation survey); non-steady state flow in mine openings; influence of the ventilation conditions upon the dynamics of the methane concentration; automation of the ventilation system. Lecture, two hours; laboratory, two hours. Prereq: MNG 341.

**#MNG 655 ADVANCED GEOMECHANICS II. (3)**

Review of 3D state of stress and strain, stress redistribution around mine openings, tunnels, wellbores, intact rock and rock mass properties, rock mass failure criteria, role of discontinuities and failure along discontinuities, rock reinforcement and support, numerical modeling in Geomechanics, FEM, FDM. Prereq: MNG 551.

**MNG 690 ADVANCED MINERAL BENEFICIATION ENGINEERING. (3)**

State of the art techniques in mineral beneficiation and their application in coal and mineral preparation industry. Prereq: MNG 301 and MNG 572.

**MNG 691 SIMULATION OF MINERAL PROCESSING CIRCUITS. (3)**

Flowsheet modeling and analysis for coal preparation and ore dressing plants. Topics include unit models for comminution, gravity separation, and froth flotation; relevant techniques for solving systems of nonlinear equations; convergence acceleration techniques; sequential modular, simultaneous modular, and equation-solving flowsheeting frameworks; flowgraph techniques for analysis of certain classes of mineral processing circuits. Prereq: MNG 575.

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- \*MNG 699 TOPICS IN MINING ENGINEERING. (3)**  
A detailed investigation of a topic of current significance in mining engineering. May be repeated to a maximum of nine credits, but only three credits can be earned under the same title. A particular topic may be offered at most twice under the MNG 699 number. Prereq: Engineering standing and consent of instructor.
- MNG 748 MASTER'S THESIS RESEARCH. (0)**  
Half-time to full-time work on thesis. May be repeated to a maximum of six semesters. Prereq: All course work toward the degree must be completed.
- MNG 749 DISSERTATION RESEARCH. (0)**  
Half-time to full-time work on dissertation. May be repeated to a maximum of six semesters. Prereq: Registration for two full-time semesters of 769 residence credit following the successful completion of the qualifying exams.
- MNG 767 DISSERTATION RESIDENCY CREDIT. (2)**  
Residency credit for dissertation research after the qualifying examination. Students may register for this course in the semester of the qualifying examination. A minimum of two semesters are required as well as continuous enrollment (Fall and Spring) until the dissertation is completed and defended.
- MNG 768 RESIDENCE CREDIT FOR THE MASTER'S DEGREE. (1-6)**  
May be repeated to a maximum of 12 hours.
- MNG 769 RESIDENCE CREDIT FOR DOCTOR'S DEGREE. (0-12)**  
May be repeated indefinitely.
- MNG 771 SEMINAR IN MINING ENGINEERING. (1)**  
Review of current research in specific areas of mining engineering. Required of all graduate students. Prereq: Graduate classification.
- MNG 780 SPECIAL PROBLEMS IN MINING ENGINEERING. (1-6)**  
Individual work on some selected design problems in one area of mining engineering. May be repeated to a maximum of six credits. Prereq: Approval of the chairperson of the department.
- MNG 790 SPECIAL RESEARCH PROBLEMS IN MINING ENGINEERING. (1-9)**  
Individual work on some selected problems in one of the various fields of mining engineering. Laboratory and field measurements, six hours. May be repeated to a maximum of nine credits. Prereq: Approval of the Director of Graduate Studies.