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 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 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 consent of instructor.

*MNG 291 ELEMENTS OF MINE DESIGN. (2)
Practical knowledge of computational tools used in mine design projects for both underground and surface mining. Basic elements in modern mine 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 264.

MNG 301 MINERALS PROCESSING. (3)

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 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; concur: MNG 264 or consent of instructor.

*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)
Descriptive statistics; random variables & probability distributions; point estimation; hypothesis testing; linear regression; time and
motion study; introduction to geostatistics. Prereq: MA 114, MNG 264.

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 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. Concur: COM 199; prereq:
engineering standing.

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. (4)
Optimization of mining systems and investment decisions based on the time value of money and the application of deterministic and
stochastic models. Application of advanced features in spread-sheet programming for solving mine systems problems. Prereq: MNG
335 and Engineering Standing.

MNG 463 SURFACE MINE DESIGN AND ENVIRONMENTAL ISSUES. (3)
Pit layout and design of excess spoil disposal areas including stability of the slopes. Design of sediment control systems to satisfy

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 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 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 561 MINE CONSTRUCTION ENGINEERING I. (3)

MNG 563 SIMULATION OF INDUSTRIAL PRODUCTION SYSTEMS. (3)
Discrete event simulation and its application to performance analysis of industrial production systems. Topics include concepts for characterizing production systems, approaches to structuring simulation models, instruction in a simulation language, and techniques for comparing alternative system designs and control strategies. Applications to manufacturing, commercial and mining production systems are considered. Prereq: CS 221 or 270, STA 281 or 381, engineering standing. (Same as MFS 563.)

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 591 MINE DESIGN PROJECT I. (2)
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. Lecture, one hour; laboratory, three hours per week. Prereq: MNG 211, MNG 291, MNG 332, 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 341, MNG 551, MNG 591, and engineering standing.

MNG 599 TOPIC IN MINING ENGINEERING. (2-3)
A detailed investigation of a topic of current significance in mining engineering. May be repeated to a maximum of six 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 690 ADVANCED MINERAL BENEFICIATION ENGINEERING. (3)
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.

MNG 699 TOPICS IN MINING ENGINEERING (Subtitle required). (3)
A detailed investigation of a topic of current interest in mining engineering. May be repeated to a maximum of six credits, but only three credits may be earned under the same subtitle. A particular topic may be offered only twice under the MNG 699 number. Prereq: 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.