The objective of this course is to introduce students to mine surveying principles, techniques, and products. Topics covered include a brief history of surveying; a brief review of trigonometry and related math needed in applications; review and application of AutoCAD needed for completing assignments; review of coordinate systems in the U.S.; discussion of types of measurements, units, and conversions that will be done; methods for doing the different types of measurements; introduction of surveying equipment and how to operate them; and use of GPS, laser scanning, 3-D imaging and photogrammetric systems. Laboratory assignments emphasize learning by doing, where students perform basic surveying functions by performing field surveying on campus and at a nearby mine, and then perform necessary calculations and plotting. Students will learn about various measurement methods and devices, error calculations, performing field surveying for topographic mapping, construction control, and volume/area measurement in surface and underground environment.

**Prerequisite:** 2nd semester standing; 1/2 unit of secondary school trigonometry

**MNG 230: Introduction to Mining Engineering**

3 Credits

Examination, development, and exploitation of mineral deposits; mining methods; unit operations; mining equipment; fundamentals of explosives.

**MNG 302: Mine Electrical Systems**

3 Credits

The infrastructure of mines includes power systems, communication and tracking systems, and monitoring systems. Larger surface and underground mines often have power systems of similar size and complexity to a large town, but with additional engineering challenges created by the need to move the power system as mining advances, the confined spaces of underground mines, and the possible presence of combustible ores or explosive gases. Specialized communication systems are required in many underground mines because radio waves propagate poorly in these spaces. Personnel tracking systems are sometimes used to provide location information for all miners. Mine-wide monitoring systems are becoming increasingly common to improve personnel safety and equipment maintainability. In total, these mine electrical systems are a vital component of modern mines. Mining engineers take the lead role in the design and specification of these systems, just as they would for the materials handling, ventilation, and other ancillary systems of the mine. The goal of this course is to develop the necessary knowledge and engineering skills so that this work can be performed in a competent and safe manner. Circuit laws and network theorems are reviewed and the analysis of circuits is presented. The use of phasors and impedance diagrams, and the concepts of complex power and the power triangle are introduced. Models for two and three-winding transformers are presented, and the fundamental electromechanical concepts for motors and generators are given. The analysis of balanced three-phase is studied. Next, the basic concepts of power system protection are addressed. Grounding, ground bed design, and related topics are presented. Shock, fire, and explosion hazards are an everyday concern in mines, and the basic approaches for mitigating these hazards are covered. Distribution and utilization system arrangements, and the typical equipment for providing power within mines, are studied. Case studies from surface and underground mines are used to illustrate the concepts. The role of load flow and fault analyses in the design and operation of mine power systems is explained, and these concepts are applied using software tools. The application fundamentals of communications, tracking, and monitoring systems are presented, along with their operational advantages and limitations. The course culminates in a final project in which the mine electrical systems for a specific mine are designed.

**Prerequisites:** PHYS 212

**MNG 331: Rock Mechanics**

3 Credits

Ground stresses, laboratory rock properties, laboratory and field instrumentation, rock mass characteristics, subsidence, slope stability, design of mine workings. MNG 331 Rock Mechanics (3) This course was designed to introduce the student to the subject of rock mechanics. It includes an introduction to experimental stress analysis, the physical properties of rock, underground stresses, laboratory and field instrumentation, model studies, rock mass properties, and the discussion of a number of rock mechanics field applications associated with mining, petroleum and civil engineering, and geoscience. A technical paper written on some field related to the laboratory and/or theoretical aspect of rock mechanics is required. A series of eight laboratory sessions are included. These give the students hands-on experience relative to the concepts and instrumentation problems discussed in lectures.

**Prerequisite:** E MCH210

**MNG 401: Introduction to Mining Operations**

1 Credits

An introduction to underground and surface mining methods; selection of extraction equipment; relevant auxiliary operations. Not intended for Mining Engineering majors.

**Prerequisite:** E MCH211

**MNG 404: Mine Materials Handling Systems**

2 Credits/Maximum of 2

The objective of this course is to provide students with the basic principles and methodology involved in design of material handling systems used in the mining industry. The course will cover various types of material handling methods and equipment including continuous and cyclic loading and transportation systems. The course will review surface mining equipment including loaders, shovels, draglines, trucks, rail, dozers and scrapers. It will also discuss underground mining and various equipment such as loaders, rail, shuttle cars and coal loaders, panel conveyance and vertical transportation including hoisting and vertical conveyor. The design approaches will be discussed including the calculation of cycles, capacity of the system and equipment selection.

**Prerequisite:** MNG 230
MNG 410: Underground Mining

3 Credits

Underground mine design; extraction techniques; description of auxiliary operations as they relate to the mining methods. MNG 410 Underground Mining (3) The purpose of this course is to describe the logic and discuss the steps taken in the planning and design of an underground mine. Since every underground mine incorporates a unique combination of technological, economic, legal, social, and environmental factors, the course will stress the auxiliary operations (ventilation, ground control, etc.) which must be accommodated, as well as the unit operations and equipment dealing with resource extraction.

**Prerequisite:** MNG 404, MNG 422, MNG 331

MNG 410H: Underground Coal Extraction

2 Credits

Underground coal-mine design; extraction techniques; description of the various auxiliary operations as they relate to the mining methods.

Honors

MNG 411: Mine Systems Engineering

2 Credits

Applied operations research and systems methods for decision making in mine operations; time and systems studies to improve productivity.

**Prerequisite:** MNG 404

MNG 412: Mineral Property Evaluation

3 Credits

Ore reserve estimation using statistics and geostatistics, mine cost estimation, engineering economy concepts applied to mineral deposits.

**Prerequisite:** MNG 030

MNG 422: Mine Ventilation and Air Conditioning

3 Credits

Quality, quantity, and temperature-humidity control of the mine atmosphere; general mine environmental control.

**Prerequisite:** C E 360, MNG 030. Prerequisite or concurrent: M E 300

MNG 441: Surface Mining Systems and Design

3 Credits

Design of surface mining for noncoal and coal minerals; emphasis on quarry and strip mining planning parameters: unit operations, systems, haulroads, draglines, spoil stability, reclamation, legal requirements, and health and safety.

**Prerequisite:** MN PR301, MNG 030

MNG 451W: Mining Engineering Project

1-5 Credits/Maximum of 5

Independent and integrative design and report of specific mine evaluation, layout, equipment selection, environmental control, permitting, and financial analysis.

**Prerequisite:** MNG 331, MNG 404, MNG 412, MNG 422 Concurrent: MNG 410 MNG 441

Writing Across the Curriculum

MNG 494H: Thesis Research

1-6 Credits/Maximum of 6

Independent research under the supervision of the Mining Engineering program.

**Prerequisite:** prior approval of program

Honors

MNG 497: Special Topics

1-9 Credits/Maximum of 9

Formal courses given on a topical or special interest subject which may be offered infrequently; several different topics may be taught in one year or term.