

# MINING ENGINEERING (MIN)

## MIN F101 Minerals, Man and the Environment

3 Credits

A general survey of the impact of the mineral industries on man's economic, political and environmental systems.

**Lecture + Lab + Other:** 3 + 0 + 0

## MIN F103 Introduction to Mining Engineering

1 Credit

Concepts and methods utilized in mining engineering and mining unit operations.

**Lecture + Lab + Other:** 1 + 0 + 0

## MIN F104 Mining Safety and Operations Laboratory

1 Credit

Practical training at the Silver Fox Mine in mining operations and safety. Course complies with Mine Safety and Health Administration (MSHA) 40 hour new miner training.

**Lecture + Lab + Other:** 0 + 3 + 0

## MIN F202 Mine Surveying

3 Credits

Offered Fall

Surveying principles for surface and underground control of mining properties. Field and office procedures for preparation of maps and engineering data.

**Prerequisites:** MATH F151X, MATH F152X.

**Lecture + Lab + Other:** 2 + 3 + 0

## MIN F225 Quantitative Methods in Mining Engineering

2 Credits

Offered Fall

Introduction to ore reserve estimation, classical estimation methods and techniques, error in estimations and pitfalls, introduction to classical statistics, introduction to geostatistics, ordinary kriging, block kriging, modeling the sample variogram, co-kriging and global estimation.

**Prerequisites:** MATH F251X.

**Lecture + Lab + Other:** 2 + 0 + 0

## MIN F226 Mine Development

2 Credits

Offered Spring

Review of pre-mining activities. Access to mining property, haul road location and design. Access to ore body; shaft, slope and ramp locations; shape, sizing and development. Development of access in frozen ground environments. Layout of development mains, cross-cuts, raises and winzes for ventilation, transport and optimum extraction of ore body. Level intervals, size and location of ore passes, design and optimization.

**Prerequisites:** MIN F103; MIN F225.

**Recommended:** MATH F251X.

**Lecture + Lab + Other:** 2 + 0 + 0

## MIN F301 Mine Plant Design

3 Credits

Quantitative study and design of various systems and equipment used in haulage, hoisting, drainage, pumping and power (compressed air and electricity). Importance of the natural conditions and production level in the equipment selection procedure emphasized.

**Prerequisites:** ES F208 and ES F307.

**Recommended:** ES F341.

**Lecture + Lab + Other:** 3 + 0 + 0

## MIN F302 Underground Mine Environmental Engineering

3 Credits

Analysis of underground mine ventilation systems, ventilation planning, design and engineering control, mine ventilation network.

**Prerequisites:** MIN F103; MIN F226; ES F341.

**Lecture + Lab + Other:** 2 + 3 + 0

## MIN F313 Introduction to Mineral Preparation

3 Credits

Offered Fall Odd-numbered Years

Elementary theory and principles of unit processes of liberation, concentration and solid-fluid separation as applied to mineral beneficiation.

**Prerequisites:** Junior standing.

**Lecture + Lab + Other:** 2 + 3 + 0

## MIN F370 Rock Mechanics

3 Credits

Physical and mechanical properties of rock; rock mass classification systems; stress distribution in the vicinity of mining openings, design criteria and support for structures in rock mass, instrumentation and monitoring of opening's stability as well as strata control and surface subsidence.

**Corequisites:** ES F331.

**Lecture + Lab + Other:** 2 + 3 + 0

## MIN F380 Computer Aided Orebody Modeling

1 Credit

Offered Fall

Develops a orebody model from drillhole data in a computer aided design environment. The data is converted into a drillhole database, following which, a 3D visual model is developed. Basic tools covered include concepts of computer aided design, database error checking and triangulation.

**Prerequisites:** GEOS F332.

**Lecture + Lab + Other:** 2 + 3 + 0

## MIN F401 Mine Site Field Trips

1 Credit

Field trips to active surface and underground mines to gain perceptual knowledge of modern mining systems by observation. Includes a systematic summarization and analysis of the mine after each visit to gain an in-depth understanding of mining engineering principles.

**Prerequisites:** MIN F202; MIN F301; MIN F302; MIN F370.

**Lecture + Lab + Other:** 0.5 + 3 + 0

## MIN F407 Mine Reclamation and Environmental Management (W)

3 Credits

Offered Fall Even-numbered Years

Principles and practices of mine reclamation and waste disposal. Pre-mining assessments and plans. Design of settling and tailings ponds and waste impoundments. Stream bed restoration and revegetation.

**Prerequisites:** CHEM F106X; WRTG F111X; WRTG F211X, WRTG F212X, WRTG F213X or WRTG F214X.

**Recommended:** ES F341.

**Lecture + Lab + Other:** 3 + 0 + 0

## MIN F408 Mineral Valuation and Economics (O)

3 Credits

Introduction to engineering economics, ore sampling and reserve calculations, and mine feasibility studies.

**Prerequisites:** COJO F131X or COJO F141X; GE F375 or MIN F301.

**Lecture + Lab + Other:** 3 + 0 + 0

**MIN F409 Operations Research and Computer Applications in Mineral Industry**

3 Credits

Fundamental concepts of probability and statistics and the use of operations research and computer techniques for understanding, analysis, forecasting and optimization of mining operations and systems.

**Prerequisites:** MIN F225; MIN F454.

**Lecture + Lab + Other:** 3 + 0 + 0

**MIN F415 Coal Preparation**

3 Credits

Unit operations, flowsheets, washability characteristics and control by sink-float methods for coal preparation plants. Market requirements and economics of preparation.

**Prerequisites:** MIN F313 or graduate standing.

**Lecture + Lab + Other:** 2 + 3 + 0

**MIN F443 Principles and Applications of Industrial Explosives**

3 Credits

Types and properties of industrial explosives; systems of initiation; theories of blasting; designs of open pit bench blasting; designs of underground blasting/rounds; applications in mining, civil construction and other fields; blasting vibration, structural damage and their control; overbreak control; safe practices; safety regulations; blast hole drilling and drilling equipment.

**Prerequisites:** MIN F370.

**Lecture + Lab + Other:** 3 + 0 + 0

**MIN F444 Accidents, Emergency and Safety Management in Mines**

3 Credits

Offered Alternate Fall

Accident statistics, accident investigation and prevention, major provisions of current laws, rule-making procedures, mine fires and explosions, causes and prevention, loss control principles and methods, emergency evacuation, emergency response and emergency preparedness, safety management systems and behavioral science applications.

**Prerequisites:** MIN F302.

**Corequisites:** MIN F454.

**Lecture + Lab + Other:** 3 + 0 + 0

**MIN F454 Underground Mining Methods**

3 Credits

Underground mining methods for coal and non-coal deposits. Includes design parameters, selection of mining methods, mine planning process, auxiliary operations and various underground mining methods.

**Prerequisites:** MIN F301; MIN F302; MIN F370.

**Lecture + Lab + Other:** 3 + 0 + 0

**MIN F482 Computer-aided Mine Design:VULCAN**

3 Credits

Offered Fall

Familiarization with VULCAN mine design software to store, manage, model and display exploration data. Estimate volume, tonnage and quality of reserve, design declines and development drives in underground and surface coal and hardrock mines, design underground and surface coal mine plans and design of underground stopes, perform underground and surface grade control.

**Prerequisites:** Junior, senior or graduate standing in Mining Engineering, Geological Engineering.

**Stacked with** MIN F682.

**Lecture + Lab + Other:** 2 + 3 + 0

**MIN F484 Surface Mining Methods**

2 Credits

Offered Spring Even-numbered Years

Modern methods of surface mine design. Strip and open pit optimization techniques. Production planning and scheduling. Use of mine design software.

**Prerequisites:** MIN F225; MIN F226; Junior or senior standing in mining engineering.

**Lecture + Lab + Other:** 2 + 0 + 0

**MIN F485 Mining Engineering Exit Interview**

0 Credit

An Exit interview will be conducted to obtain feedback on the program.

**Prerequisites:** Senior standing in mining engineering.

**Corequisites:** MIN F490.

**Lecture + Lab + Other:** 0 + 0 + 0

**MIN F489 Mining Design Project I**

1 Credit

Offered Fall

This course is a pre-cursor to MIN F490. The student is expected to meet with the instructor to finalize the senior design project topic, lay out a project plan, gather data and prepare as necessary for the successful execution of the project in MIN F490. Note: Both MIN F489 and MIN F490 must be completed to fulfill the writing intensive requirement.

**Prerequisites:** WRTG F111X; WRTG F211X, WRTG F212X, WRTG F213X or WRTG F214X; MIN F301; MIN F302; MIN F370.

**Lecture + Lab + Other:** 1 + 0 + 0

**MIN F490 Mining Design Project II (W)**

2 Credits

Offered Spring

Design of mine layout including extraction and beneficiation, and economic evaluation of a mining project. A comprehensive written report of the design and analysis is required. Note: Both MIN F489 and MIN F490 must be completed to fulfill the writing intensive requirement.

**Prerequisites:** WRTG F111X; WRTG F211X, WRTG F212X, WRTG F213X or WRTG F214X; MIN F301; MIN F302; MIN F370; MIN F454; MIN F489.

**Lecture + Lab + Other:** 1 + 4 + 0

**MIN F601 Application of Artificial Neural Networks**

3 Credits

Basic neural network architectures, including rules, training methods and practical applications. Training and application issues typical of earth sciences problems. Some topics require mathematical analysis. Genetic algorithms and use of network ensembles will be briefly presented.

**Prerequisites:** Graduate standing in engineering; programming ability; knowledge of MATLAB, a plus.

**Recommended:** MATH F253X, MATH F314; MIN F408; MIN F635.

**Lecture + Lab + Other:** 3 + 0 + 0

**MIN F621 Advanced Mineral Economics**

3 Credits

Introduction to options valuation of mineral projects; uncertainty and risk in mineral valuations; stochastic price models; dynamic programming and investment analysis; real options techniques.

**Prerequisites:** Admission by arrangement.

**Lecture + Lab + Other:** 3 + 0 + 0

**MIN F631 Research Methods in Mineral Engineering**

4 Credits

Research methods including problem definition and statement, designing experiments, collecting and interpreting data. Methods of theoretical and experimental analysis will be reviewed and examples given.

**Prerequisites:** Graduate standing.

**Lecture + Lab + Other:** 3 + 3 + 0

**MIN F635 Advanced Geostatistical Applications**

3 Credits

Offered Spring

Introduction to the theory and application of geostatistics. Review of classical statistics, continuous and discrete distributions, hypothesis testing and global estimation. Presentation of fundamental geostatistical concepts including: variogram, estimation variance, block variance, kriging, geostatistical simulation. Emphasis on the practical application of geostatistical techniques.

**Prerequisites:** MIN F408; graduate standing.

**Cross-listed with** GE F635.

**Lecture + Lab + Other:** 2 + 3 + 0

**MIN F637 Mine Systems Simulation**

3 Credits

Application of computer simulation to the analysis of static and dynamic mine systems and the development of useful programs for mine operators. Design of simulation experiments in mining engineering.

**Prerequisites:** MIN F409; graduate standing.

**Lecture + Lab + Other:** 2 + 3 + 0

**MIN F652 Numerical Methods in Mine Ventilation**

3 Credits

Differencing schemes for the partial differential equations of flow in mine networks, typical boundary conditions for mine ventilation systems, computer-aided solution techniques. Application to flow of fluids through porous media is covered.

**Prerequisites:** MIN F302; graduate standing.

**Lecture + Lab + Other:** 2 + 3 + 0

**MIN F673 Advanced Rock Mechanics**

3 Credits

The study of theoretical and experimental methods in rock mechanics. State of stress and potential failure zone around two- and three-dimensional structures in rock based on theoretical, numerical and experimental techniques and failure criteria are presented.

**Prerequisites:** MIN F370; graduate standing.

**Lecture + Lab + Other:** 2 + 3 + 0

**MIN F674 Advanced Ground Control**

3 Credits

A study of current rock mechanic problems related to advances in mining and construction technologies. Particular emphasis on the importance of rock and frozen ground properties and stress evaluation in designing and monitoring stability of structures for gas, oil and radioactive materials storage, geothermal energy recovery, solution mining, and those exposed to rock outbursts and earthquakes. Rock and frozen ground properties related to other dynamic loading conditions, such as in blasting, are also discussed.

**Prerequisites:** MIN F370.

**Lecture + Lab + Other:** 0 + 0 + 0

**MIN F682 Computer-aided Mine Design:VULCAN**

3 Credits

Offered Fall

Familiarization with VULCAN mine design software to store, manage, model and display exploration data. Estimate volume, tonnage and quality of reserve, design declines and development drives in underground and surface coal and hardrock mines, design underground and surface coal mine plans and design of underground stopes, perform underground and surface grade control.

**Prerequisites:** Graduate standing in Mining Engineering or Geological Engineering.

**Stacked with** MIN F482.

**Lecture + Lab + Other:** 2 + 3 + 0

**MIN F688 Graduate Seminar I**

1 Credit

Preparation and presentation of research outlines by graduate students and participation in regularly organized mineral engineering department seminars.

**Prerequisites:** Admission to graduate program.

**Cross-listed with** MPR F688.

**Lecture + Lab + Other:** 1 + 0 + 0

**MIN F698 Non-thesis Research/Project**

1-9 Credits

**Lecture + Lab + Other:** 0 + 0 + 0

**MIN F699 Thesis**

1-9 Credits

**Lecture + Lab + Other:** 0 + 0 + 0