## MINING ENGINEERING (MIN)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>MIN F101</td>
<td>Minerals, Man and the Environment</td>
<td>3</td>
<td>A general survey of the impact of the mineral industries on man's economic, political and environmental systems.</td>
</tr>
<tr>
<td>MIN F103</td>
<td>Introduction to Mining Engineering</td>
<td>1</td>
<td>Concepts and methods utilized in mining engineering and mining unit operations.</td>
</tr>
<tr>
<td>MIN F104</td>
<td>Mining Safety and Operations Laboratory</td>
<td>1</td>
<td>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.</td>
</tr>
<tr>
<td>MIN F202</td>
<td>Mine Surveying</td>
<td>3</td>
<td>Surveying principles for surface and underground control of mining properties. Field and office procedures for preparation of maps and engineering data.</td>
</tr>
<tr>
<td>MIN F225</td>
<td>Quantitative Methods in Mining Engineering</td>
<td>2</td>
<td>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.</td>
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<tr>
<td>MIN F226</td>
<td>Mine Development</td>
<td>2</td>
<td>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.</td>
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<tr>
<td>MIN F301</td>
<td>Mine Plant Design</td>
<td>3</td>
<td>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.</td>
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<tr>
<td>MIN F302</td>
<td>Underground Mine Environmental Engineering</td>
<td>3</td>
<td>Analysis of underground mine ventilation systems, ventilation planning, design and engineering control, mine ventilation network.</td>
</tr>
<tr>
<td>MIN F313</td>
<td>Introduction to Mineral Preparation</td>
<td>3</td>
<td>Offered Fall Odd-numbered Years. Elementary theory and principles of unit processes of liberation, concentration and solid-fluid separation as applied to mineral benefications.</td>
</tr>
<tr>
<td>MIN F370</td>
<td>Rock Mechanics</td>
<td>3</td>
<td>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.</td>
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<tr>
<td>MIN F380</td>
<td>Computer Aided Orebody Modeling</td>
<td>1</td>
<td>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.</td>
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<tr>
<td>MIN F401</td>
<td>Mine Site Field Trips</td>
<td>1</td>
<td>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.</td>
</tr>
<tr>
<td>MIN F408</td>
<td>Mineral Valuation and Economics</td>
<td>3</td>
<td>Introduction to engineering economics, ore sampling and reserve calculations, and mine feasibility studies.</td>
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Prerequisites and co-requisites are as follows:

- MIN F101: MIN F226; ES F341; Co-requisite: GE F375 or MIN F301.
- MIN F103: MIN F226; Co-requisite: ES F341.
- MIN F104: MATH F151X, MATH F152X or equivalent.
- MIN F202: MATH F151X or equivalent; or permission of instructor.
- MIN F225: MATH F251X or equivalent; or permission of instructor.
- MIN F226: MIN F103; MIN F225; or permission of instructor.
- MIN F302: MIN F103, MIN F226; ES F341.
- MIN F313: MIN F103; MIN F226; ES F341.
- MIN F370: MIN F202; MIN F301; MIN F302; MIN F370.
- MIN F401: MIN F202; MIN F301; MIN F302; MIN F370.
- MIN F407: MIN F202; MIN F301; MIN F302; MIN F370.
- MIN F408: MIN F103; MIN F226; Co-requisite: ES F341.
- MIN F401: MIN F202; MIN F301; MIN F302; MIN F370.
- MIN F407: MIN F202; MIN F301; MIN F302; MIN F370.
- MIN F408: MIN F103; MIN F226; Co-requisite: ES F341.
- MIN F401: MIN F202; MIN F301; MIN F302; MIN F370.
- MIN F407: MIN F202; MIN F301; MIN F302; MIN F370.
- MIN F408: MIN F103; MIN F226; Co-requisite: ES F341.
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 or equivalent; or permission of instructor.  
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 or permission of instructor.  
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; MIN F454, concurrently.  
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, or permission of instructor.  
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 or permission of instructor.  
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.  
Co-requisites: MIN F490.  
Prerequisites: Senior standing in mining engineering.  
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 or WRTG F213X; MIN F301; MIN F302; MIN F370; or permission of instructor.  
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 or WRTG F213X; MIN F301; MIN F302; MIN F370; MIN F454; MIN F489; or permission of instructor.  
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 or permission of instructor.
*Lecture + Lab + Other: 3 + 3 + 0*

MIN F635  Geostatistical Ore Reserve Estimation
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 or equivalent; graduate standing; or permission of instructor.
*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 or equivalent; 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 or equivalent; 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 or equivalent or 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 or equivalent or permission of instructor.
*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 coal and hardrock mines, design underground coal mine plans and design of underground stopes, perform underground grade control.
**Prerequisites:** Graduate standing in Mining Engineering or Geological Engineering; or permission of instructor.
*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*