

## A. Mining Engineering and Management Course Syllabi

### MEM 120 – INTRODUCTION TO MINING, MANAGEMENT & SUSTAINABLE DEVELOPMENT

#### Required

Meets MONDAYS, 2:00 – 3:50 in MI 222

#### **Catalog Data:**

(2-0) 2 Credits – Prerequisites: None. Principles and definitions related to mining engineering discipline. Introductory overview of current mining practices and the mining technology in general. Presentation of mining faculty and their areas of expertise. Discussion of various career paths in mining engineering. Principles, terminology and definitions of sustainable development in mining. Elements and indicators of sustainable development: environment, economics, society and governance. Introductory concepts in management dealing with mining and global issues.

#### **Textbook:**

SME, *Surface Mining*, 2<sup>nd</sup> Edition, 1990.

Mining Explained, The Northern Miner

#### **References:**

IIED Report on Sustainable Development

#### **Outcomes:**

Students completing this class will be able to demonstrate:

- an understanding of the preliminary concepts of Mining & Sustainable Development relating to surface & underground mining techniques, equipment and operations
- the ability to use the techniques, skills and modern engineering & management tools necessary to function effectively in the mining environment (introductory level)

#### **Course Requirements:**

Course Evaluation: The final grade in this class will be based upon:

- Attendance & class participation (80%)
- Exams & homework assignments (10%)
- Projects & accompanying reports (10%)

#### **Topics:**

- Introduction, history of mining and basic definitions & Careers in mining engineering
- Surface, Quarrying & Underground mining – Basic introduction
- Tunneling and shaft sinking - Basic
- Basic elements of equipment in the mining environment
- HIGH-TECH Mining – What's new (Computer applications in mining and mining software)
- Management Concepts such as, Project Management, Team dynamics, Meeting skills etc.
- Historical overview of the role of the mining industry in the modern world
- Explore one of the hundreds of sustainable development projects through the Internet: Choose a mining project and discuss the approach and the solution.

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**Date:** January 2009

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## MEM 201—SURVEYING FOR MINERAL ENGINEERS

### Required

Meets Tu & Th, 1:00 – 3:50 in MI 222

#### **Catalog Data:**

(0-2) 2 credits. Prerequisite: Sophomore standing. Principles of surface and underground surveying, including measurements, data collection, calculations, error analysis, topographic mapping, and application of the Global Positioning System.

#### **Textbook:**

Wolf, Paul R & Charles D. Ghilani, *Elementary Surveying An Introduction to Geomatics*, 10<sup>th</sup> ed., Prentice hall, 2002.

#### **Outcomes:**

After completion of this course, students will be able to demonstrate:

- an ability to apply knowledge of mathematics, science, and engineering to mine surveying problems;
- an ability to design and conduct proper mine surveys, as well as accumulate, analyze and interpret the field data;
- an ability to function as a member of a survey team;
- an ability to identify, formulate, and solve typical engineering problems associated with mine surveying; and
- an ability to properly use the techniques, skills, and equipment necessary for good surveying practices.

#### **Course Requirements:**

Course Evaluation: The final grade in this class will be based upon:

- Two examinations (~40%)
- Homework problems (~20%)
- Group project reports (~30%)
- Group & class participation (~10%)

#### **Topics:**

1. Introduction
2. Units and Significant Figures
3. Theory of Errors In Observations
4. Angles, Azimuths and Bearings
5. Coordinate Calculations
6. Boundary Surveys
7. Alignment surveys
8. GPS
9. Field survey projects

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**MEM 202 Materials Handling and Transportation**  
**Required**  
**Meets M & W, 9:00 – 9:50 a.m., MI 220**

**Catalog Data:**

(2–0) 2 credits Prerequisites EM 216 and MEM 120. The theory of operation of mining equipment, and its selection and application to materials handling in surface and underground mines. Emphasis is on economics, productivity, reliability and safety.

**Textbook:**

None

**References:**

*SME Mining Engineering Handbook*, 1992. SME  
*Underground Mining Methods Handbook*, 1982.  
Zbigniew J. Hladysz, -- Lectures (PP).  
Ronald M. Hayes & Assoc., *Modern Materials Handling*, McGraw-Hill Publications.  
Kliche, C.A., *Surface Mining Systems PPT*.

**Outcomes:**

- Ability to apply basic knowledge of mathematics and engineering science to problems in mine design and planning;
- Ability to apply basic knowledge of mining engineering fundamentals, relevant technologies as well as techniques, skills and tools needed in mine design, planning and mine operation;
- Ability to develop problem solving capabilities and apply them in mine design, planning and mine operation;
- Ability to communicate effectively.

**Course Requirements:**

1. Students are expected to perform to a high standard and honesty, according to the rules currently at SDSM&T.
2. Class attendance is mandatory
3. No late homework assignments will be accepted, nor will tests be given other than at the scheduled time without prior written excuse that is approved by the instructor.

Grading: 50% - Tests and Final Exam; 50% - Homework Assignments

**Topics:**

1. Principles and fundamental concepts of materials handling
2. Cyclic and continuous mining operations
3. Underground Materials Handling Systems: Loading equipment; Rubber-tired haulage; Rail haulage; Conveyors; Crushing; Hoisting; Supply haulage and transportation.
4. Surface Mining Materials Handling Systems: Continuous unit operations; Multi-bucket machines; Non-continuous unit operations; In-pit crushing and conveying

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## MEM 203 – INTRODUCTION TO MINE HEALTH AND SAFETY

### Required

Meets Wednesdays, 3:00 – 4:00 in MI 222

#### **Catalog Data:**

1(1-0). Prerequisite: Sophomore standing. Introduction to mine health and safety and to the MSHA regulations. A study of mine regulations, and the recognition of mine hazards along with their prevention and control. Fulfills MSHA requirements for new miner training.

#### **Textbook:**

None

#### **References:**

MSHA Training Materials & Various Videos

#### **Outcomes:**

Students completing this class will be able to demonstrate:

- a supervisory knowledge of mine health and safety issues
- an understanding of MSHA requirements for new miner and annual safety training
- a familiarity with 45 CFR Parts 46 and 48

#### **Course Requirements:**

Course Evaluation: The final grade in this class will be based upon:

- Attendance (25%)
- Class participation (25%)
- Completion and presentation of mid-term & final reports (50%)

#### **Topics:**

1. Introduction and course review
2. Rights of Miners and Authority and Responsibility of Supervisors
3. Introduction to the Work Environment Including Transportation Systems, Control Systems, and Communication Systems.
4. Self-Rescue, Escape, and Emergency Evacuation
5. Firefighting and Firewarning
6. Ground Control – Highwalls, Water Hazards, Pits, and Spoil Banks
7. Electrical Hazards
8. Health
9. First Aid
10. Explosives
11. Hazard Recognition and Avoidance.

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## MEM 204 – SURFACE MINING METHODS AND UNIT OPERATIONS

### Required

Meets MW, 2:00 – 2:50 in MI 220

#### **Catalog Data:**

(2-0) 2 Credits – Prerequisite: ENVE/MEM 120 or permission of instructor. A study of surface mining techniques and unit operations applicable to metal mining, coal mining, quarrying and other surface mining operations. Topics include mine design and planning, surface drilling and blasting, the applicability and performance characteristics of earthmoving equipment, and an introduction of mine drainage. This course is cross listed with ENVE 204.

#### **Textbook:**

SME, *Surface Mining*, 2<sup>nd</sup> Edition, 1990.

#### **References:**

B-E, *Surface Mine Supervisory Training Program, Shovel/Truck.*

B-E, *Surface Mine Supervisory Training Program, Dragline.*

Malhotra, D., *Politics of Mining. What They Don't Teach You in School*, SME

#### **Outcomes:**

Students completing this class will be able to demonstrate:

- an understanding of the engineering principles relating to surface mining techniques, equipment and operations
- the ability to design a simple mining system, component or process to meet a desired need
- the ability to identify, formulate, and solve surface mine engineering problems
- the ability to use the techniques, skills and modern engineering tools necessary to function effectively in a surface mining environment

#### **Course Requirements:**

Course Evaluation: The final grade in this class will be based upon:

- Attendance & class participation (20%)
- Exams & homework assignments (50%): Exams (2) & homework problems (3-5).
- Projects & accompanying reports (30%)

#### **Topics:**

- A. Introduction
- B. Major U.S. Surface Mining Districts
- C. Mine Planning
- D. Surface Mining Methods
- E. Ore reserve estimation
- F. Surface Mining Equipment
- G. Mining Law and Reclamation
- H. Mine Management Case Situations

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**MEM 301 Computer Applications in Mining**  
**Required**

**Tu. 9:00 – 10:50, Th. 9:00 – 10:50 AM, MI 223**

**Catalog Data:**

(1–1) 2 credits. Prerequisites: GES 115, Professionalism in Engineering and Science. Computer Hardware and software. Applications in exploration and resource modeling, equipment selection and simulations, mine planning and design, rock stability analysis, and economics and cost estimates. Emphasis on three-dimensional modeling and visualization. Vulcan software and other software applications.

**Textbook:**

None

**References:**

Mining Software Library – User Manuals, lecture PP presentations.

**Relationship of Course to Program Outcomes:**

MEM 301 Computer Applications in Mining, meets the following outcomes for the mining engineering and management program:

- Ability to apply basic knowledge of mining engineering fundamentals, relevant technologies as well as techniques, skills and tools needed in mine design, planning and mine operation;
- Ability to develop problem solving capabilities and apply them in mine design, planning and mine operation;
- Ability to work as a team member and practically apply this skill in mining engineering analysis, design and planning, and mine operation;
- Ability to communicate effectively;
- Ability to design and conduct experiments, as well as to analyze and interpret data;
- Laboratory, technical, and computer competence;

**Course Requirements:**

- Students are expected to perform to a high standard and honesty, according to the rules currently at SDSM&T.
- Class attendance is mandatory
- No late homework assignments will be accepted, nor will tests be given other than at the scheduled time without prior written excuse that is approved by the instructor.
- Grading: 50% - Tests and Final Exam; 50% - Homework and Laboratory Assignments, Projects, and class attendance

**Topics:**

- |  |  |
|--|--|
| 1. Computer hardware and operating systems | 2. Basic concepts of computer applications |
| 3. Computer software                       | 4. General applications                    |
| 5. Integrated modeling                     | 6. Databases                               |
| 7. Mapping                                 | 8. CAD                                     |
| 9. Mineral resources                       | 10. Equipment selection                    |
| 11. Cost estimating                        | 12. Mine economics                         |
| 13. Engineering analysis                   | 14. Numerical analysis                     |
| 15. Data acquisition                       |  |

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## MEM 302 – MINERAL ECONOMICS & FINANCE

### Required

Meets MWF, 12:00 – 12:50 in MI 220

#### **Catalog Data:**

(3-0) 3 Credits – Prerequisite: Junior Standing. An introduction to the concepts of the time value of money and the application of time value of money decision criteria to mineral project evaluation situations. Both before-tax and after-tax investment situations are discussed. A discussion of the financing options available to a company for expansion, new project development or acquisitions. This course is cross-listed with ENVE 302.

#### **Textbook:**

Stermole, F.J., and J.M. Stermole, *Economic Evaluation and Investment Decision Methods*, 10<sup>th</sup> ed., Investment and Evaluations Corp., 2000.

#### **References:**

Gentry, D.W., and T.J. O'Neil, *Mine Investment Analysis*, SME, 1984.

#### **Outcomes:**

Upon completing this course, the student will be able to:

1. Solve basic time-value-of-money economic problems
2. Conduct a mineral project economic analysis
3. Evaluate equipment replacement options
4. Determine cost of capital to the firm and know how it's applied
5. Follow and understand various aspects of the commodities market and players in the market.

#### **Course Requirements:**

Course Evaluation: The final grade in this class will be based upon:

- Attendance & class participation (20%)
- Exams & homework assignments (60%)
- Final project & report (20%)

#### **Topics:**

1. Introduction
2. Compound interest formulas
3. Present worth, annuities, future worth, rate of return, and break-even analysis
4. Project analysis
5. Escalated dollar analysis, constant dollar analysis and inflation
6. Sensitivity analysis and risk analysis
7. Depreciation, depletion and amortization
8. Income tax, cash flow, DCFROR
9. After-tax investment decisions
10. Replacement analysis
11. Leverage concepts
12. Cost of capital to the firm
13. Cut-off grades and ore accounting
14. Stock/bond investments

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## MEM 303 – UNDERGROUND MINING METHOD AND EQUIPMENT

### Required

Meets WF, 9:00 – 9:50 in MI 320

#### **Catalog Data:**

(2-0) 2 credits. Prerequisite: Sophomore or junior standing. A study of underground mining techniques, unit operations, and equipment applicable to coal mining, metal mining, quarrying and tunneling operations. Topics include mining method selection, mine design and planning, drilling and blasting, and novel underground mining methods.

#### **Textbook:**

Power point Presentation slides

#### **References:**

Introduction to Mining Engineering, *H.L Hartman*, SME

#### **Outcomes:**

Students completing this class will be able to demonstrate:

- An understanding of the engineering principles relating to underground mining techniques, equipment and operations
- The ability to design a simple mining system, component or process to meet a desired need
- The ability to identify, formulate, and solve underground mine engineering problems
- The ability to use the techniques, skills and modern engineering tools necessary to function effectively in an underground mining environment

#### **Course Requirements:**

Course Evaluation: The final grade in this class will be based upon:

- Quiz and term paper (20%)
- Homework assignments (50%):
- Exams (30%)

#### **Topics:**

- A. Introduction
- B. Ore deposits
- C. Mine Development
- D. Drilling
- E. Blasting
- F. Rock Breakage
- G. Unsupported Methods
- H. Supported Mining Methods
- I. Caving Methods
- J. Novel methods
- K. Supports
- L. Non mining-Use of underground Space
- M. Mine Management

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**MEM 304 – Theoretical and Applied Rock Mechanics**  
**Required**

**MI 327 lecture 10:00 – 10:50 AM MWF**

**MI 120 laboratory 1:00 – 3:50 PM TH**

**Catalog Data:**

(4-1) 4 credits. Prerequisite: EM 216 and junior standing. Principles of rock mechanics and mechanics of materials. Concept of stress, strain and the theory of elasticity. Applications in mining, geological engineering and tunneling. Emphasis on the design of safe structures in rocks. Laboratory experience for determining the basic physical and mechanical properties of rocks.

**Textbook:**

Zbigniew J. Hladysz, *Rock Mechanics -- Principles and Applications*, SDSM&T, 1997.

Zbigniew J. Hladysz, *A Laboratory Manual for Rock Mechanics*, SDSMT, 1994

**References:**

B. Brady and E. T. Brown, *Rock Mechanics for Underground Mining*, George Allen & Unwin, 1985.

E. Hoek and E. T. Brown, *Rock Slope Engineering*, IMM, 1981

**Relationship of Course to Program Outcomes:**

- Ability to apply basic knowledge in mathematics, science, and engineering;
- Field, laboratory, technical, and computer competence;
- Ability to communicate effectively;
- Broad, general knowledge of the role of engineering solutions in society;
- An understanding of professional and ethical responsibility;
- Ability to identify, formulate, and solve engineering problems;
- Ability to design a system or process to meet desired needs; and
- Ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

**Requirements and Expectations:**

1. Students are expected to perform to a high standard and honesty, according to the rules currently at SDSM&T.
2. Class attendance is mandatory.
3. No late homework assignments will be accepted, nor will test be given other than at the scheduled time without prior written excuse that is approved by the instructor.
4. Grading: 10% - Lab Quizzes; 20% - Successful completion of all required rock tests, analyses and reports; 20% - Homework Assignments; 50% - Tests and Final Exam

**Topics:**

- |  |   |
|--|---|
| 1. Analysis of stresses and strains                    | 2. Theory of elasticity                       |
| 3. Physical properties of rocks                        | 4. Rock behavior                              |
| 5. Mechanical properties of rocks                      | 6. Theories of failure                        |
| 7. Stresses in earth's crust                           | 8. Rock mechanics instrumentation             |
| 9. Stress distribution around underground structures   | 10. Stability of underground structures       |
| 11. Engineering design                                 | 12. Design of supports and rock reinforcement |
| 13. Rock mechanics classifications -- empirical design | 14. Slope stability                           |
| 15. Numerical methods                                  | 16. Time-dependent properties of rocks        |

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**Date:** January, 2007



## MEM 305 – INTRODUCTION TO EXPLOSIVES ENGINEERING

### Required

Meets MWF, 2:00 – 2:50 in MI 220

#### **Catalog Data:**

(3-0) 3 Credits – Prerequisite: MEM 202. An introduction to explosives products; the theory of rock breakage by explosives; and the design of blast patterns for different applications including surface blasting techniques, underground blasting techniques, controlled blasting and specialized techniques. The techniques and equipment used to control and/or monitor airblast, ground vibration and flyrock are studied.

#### **Textbook:**

Konya, C.J., *Rock Blasting and Overbreak Control*, 3<sup>rd</sup> Ed., U.S. DOT, 2006.

#### **References:**

ISEE, *Blaster's Handbook*, 17<sup>th</sup> Edition. ISEE, Cleveland, OH. 1998.  
Konya, C.J. and E.J. Walter, *Surface Blast Design*, Prentice Hall, 1990.  
Siskind, D.E., *Vibrations From Blasting*, ISEE, 2000.  
Oriard, L.L., *The Effects of Vibrations and Environmental Forces*, ISEE, 1999.  
Dowding, C.H., *Blast Vibration Monitoring and Control*, Prentice Hall, 1985.  
Atlas Powder Co., *Explosives and Rock Blasting*, 1987.

#### **Outcomes:**

After completion of this course, students will be able to demonstrate:

- a knowledge of various types of explosives products and accessories,
- an ability to design a blast pattern to meet production goals,
- an ability to design a blast pattern to minimize environmental impacts,
- an ability to identify, formulate, and solve typical explosives engineering problems, and
- a general knowledge of the pertinent laws applicable to the explosives industry.

#### **Course Requirements:**

Course Evaluation: The final grade in this class will be based upon:

- Two examinations (~50%)
- Homework problems (~40%)
- Class & field trip participation (~10%)

#### **Topics:**

1. Explosives engineering
2. Explosives products
3. Initiators and blast hole delay devices
4. Mechanics of rock breakage
5. Priming and boosting
6. Blast design
7. Pattern design
8. Overbreak control
9. Site conditions and field procedures
10. Ground vibration, airblast and pre-blast surveys
11. Blasting safety
12. Estimating

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## MEM 307 – MINERAL EXPLORATION & GEOSTATISTICS

### Required

Meets MWF, 10:00 – 10:50 in MI 320

#### **Catalog Data:**

(3-0) 3 Credits – Prerequisite: GeoE 221. The application of the theory of geostatistics to quantify the geological concepts of (1) area of influence of a sample, (2) the continuity of the regionalized variable within a deposit, and (3) the lateral changes in the regionalized variable according to the direction. Basic concepts and theory of probability and statistics will be introduced, including probability distributions, sampling distributions, treatment of data, the mean, variance, and correlation. Computer techniques will be extensively used for geostatistical estimation of grade, volume and variance.

#### **Textbook:**

None

#### **References:**

Journal, A.G., and Ch.J. Huijbregts, *Mining Geostatistics*. The Blackburn Press, Caldwell, NJ, 2003.  
-----, *GS<sup>+</sup> GeoStatistics for the Environmental Sciences*, Gamma Design Software v.7 manual.  
Barnes, M.P., *Computer-Assisted Mineral Appraisal and Feasibility*. SME, 1980.  
Crawford & Hustrulid, eds., *Open Pit Mine Planning and Design*. SME, 1979.  
Miller, I. & John E. Freund, *Probability and Statistics for Engineers*. Prentice-Hall, 1985.

#### **Outcomes:**

After completion of this course, students will be able to demonstrate:

- a knowledge of basic statistical concepts,
- a working knowledge of mining geostatistics,
- an ability to solve typical statistics problems,
- a working knowledge of mineral resource exploration
- a knowledge of computer assisted mineral reserve estimation

#### **Course Requirements:**

Course Evaluation: The final grade in this class will be based upon:

- Attendance & class participation (20%)
- Exams & homework assignments (50%)
- Final project & report (30%)

#### **Topics:**

1. Basic Engineering Statistics: Statistical Parameters (mean, variance, standard deviation, coefficient of variation); Probability Theory; Probability Distributions; Histograms; The Normal Distribution; The Lognormal Distribution; The Uniform, Gamma and Exponential Distributions; Sampling Distribution of the Mean; Inferences Concerning Means; Regression Analysis.
2. Geostatistics: Introduction to Matheronian Geostatistics; The Variogram; Block and Volume Variance; Estimation Variance; GS<sup>+</sup> Geostatistics Computer Package; Cross Validation; Grade Estimation; Example of Point Kriging.
3. Exploration: Concept of Prospecting and Exploration; Geologic Mapping; Geologic Data Collection and Data Recording; Sample Collection Techniques; Drilling and Coring Techniques; Drill Logging; Digital Database; Basic Definitions of Mineral Resources; Classification of Economic Minerals; Resource Modeling; Exploration Geochemistry; Geophysical Exploration; Remote Sensing; Exploration Program Management.

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**MEM 401 – THEORETICAL AND APPLIED MINE VENTILATION**  
**Required**  
**Meets MWF 11:00 – 11:50 AM in MI 223 and 1:00 – 3:50 PM Vent Lab**

**Catalog Data:**

(3–1) 4 Credits. Prerequisites: MEM 303 Underground Mining Methods and Equipment; EM 328 Applied Fluid Mechanics. Analysis of mine atmosphere and the control of airflow in an underground mine. Basic principles of thermodynamics and air conditioning. Emphasis is on solutions of airflow networks and the design principles for mine ventilation systems. Laboratory experience for determining the basic pressure and airflow parameters, ventilation network analysis and fan characteristics.

**Textbook:**

H. L. Hartman, *Mine Ventilation and Air Conditioning*, John Wiley and Sons, 1997.  
Zbigniew J. Hladysz, *A Laboratory Manual for Mine Ventilation*, SDSM&T, 2007.

**References:**

*SME Mining Engineering Handbook*, SME, 1992

**Outcomes:**

After completion of this course, students will be able to demonstrate:

- an understanding of the engineering principles relating to mine ventilation,
- the ability to design a ventilation network, component or process to meet a desired need,
- the ability to identify, formulate, and solve ventilation problems, and
- the ability to use the techniques, skills and modern engineering tools necessary to function effectively in an underground mining environment.

**Course Requirements:**

Course evaluation: Tests (50%), Homework (25%) and Laboratory (25%)  
Mandatory class attendance.

**Topics:**

- Thermodynamics of air, air properties, gas laws and air quality
- Airflow, ventilation circuits and ventilation networks
- Natural ventilation and mine fans
- Ventilation control
- Thermodynamics of compressible Airflow
- Ventilation Network Analysis
- Ventilation System Design
- Mine Fires
- Air Conditioning
- Network analysis using VNETPC and Vulcan software
- Laboratory experiments

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## MEM 405 – MINE PERMITTING AND RECLAMATION

### Required

Meets MWF, 1:00 – 1:50 p.m. in MI 220

#### **Catalog Data:**

(3-0) 3 Credits – Prerequisite: Junior standing. A study of environmental problems associated with both surface and underground mining and the reclamation practices that have been developed or are being evaluated to alleviate these problems. Federal, state and local reclamation regulations are examined for their effects on present and future mining practices and costs. Field trips to several mining operations in the Black Hills or the Powder River Basin will be taken for on-site observation of actual reclamation practices. This course is cross-listed with ENVE 405.

#### **Textbook:**

Kubasek, Nancy K. & Gary S. Silverman, *Environmental Law*, 5<sup>th</sup> edition, Prentice Hall, 2005.

#### **References:**

American Assoc. of Agronomy, *Reclamation of Drastically Disturbed Lands*, 1978.

Various EPA reports.

Lehr, J.H., *Rational Readings on Environmental Concerns*, Van Nostrand Reinhold, 1992.

-----, *Code of Federal Regulations for Mineral Resources*, Office of the Federal Register.

#### **Outcomes:**

After completion of this course, students will be able to demonstrate:

- an understanding of the professional and ethical responsibility of the mining professional towards man and his environment
- a knowledge of some of the more important contemporary environmental issues facing the mining professional
- an ability to use basic research skills and appropriate documentation of sources to write effectively of issues facing the mining professional

#### **Course Requirements:**

Course Evaluation: The final grade in this class will be based upon:

- Attendance & class participation (20%)
- Two (2) term reports (80%)

#### **Topics:**

1. Introduction: Important Environmental and Related Political Terminology
2. Part 1: Environmental & Mining Law—The American Legal System; Ecology's Ancestry; The National Environmental Policy Act (NEPA) of 1969; Air-Quality Control; Water-Quality Control; Waste Management and Hazardous Releases; The Surface Mining Control and Reclamation Act (SMCRA) of 1977; The Federal Land Policy and Management Act (FLPMA) of 1976; The Mining Law of 1872, the Mineral Leasing Act of 1920, and the Materials Act of 1955; State Mining and Reclamation Laws and Regulations; Mining and Sustainable Development
3. Part 2: Mined Land Reclamation—Seedbed Preparation; Soil Stabilization Measures; Restoring Problem Soils; Primary Factors Affecting Seed Germination, Plant Establishment, and Growth; Vegetative Stabilization; Plant Materials and Requirements for Growth in Dry Regions; Soil Erosion and Sedimentation; Acid Mine Drainage
4. Guest Speakers
5. Videos

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**Date:** January 2007



## MEM 450/550 – ROCK SLOPE ENGINEERING

Elective

Meets MWF, 11:00 – 11:50, MI 220

### Catalog Data:

(3-0) 3 Credits – Prerequisite: MinE 411, MEM 304, or CEE 346, or equivalent. Topics include: modes of slope failure; economic consequences of instability in mining and construction; geologic factors controlling stability of rock slopes; shear strength of highly jointed rock masses and discontinuities; projection methods; vectoral analysis of 3-D problems by means of the stereographic projection method; analytical, graphical and computer analysis of planar, wedge and toppling failures; and probabilistic methods.

### Textbook:

Kliche, C.A., *Rock Slope Stability*, SME, 1999.

### References:

Hoek, E., and J.W. Bray, *Rock Slope Engineering*, E. & F.N. Spon, 1981.  
Brawner, C.O., and V. Milligan, *Stability in Open Pit Mining*, SME, 1971.  
Brawner, C.O., and V. Milligan, *Geotechnical Practice for Stability in Open Pit Mining*, SME, 1972.  
Brawner, C.O., *Stability in Surface Mining*, SME, 1982.  
Priest, S.D., *Hemispherical Projection Methods In Rock Mechanics*, George Allen & Unwin, 1985.  
Coates, D.F., *Pit Slope Manual*, CANMET, 1977.  
Schuster, R.L., & R.K. Krizek, *Landslides, Analysis and Control*, National Academy of Sciences, 1978.

### Outcomes:

The student completing this class will have a comprehensive understanding of:

- rock slope stability analysis techniques
- rock slope stabilization techniques
- rock slope stability analysis techniques, including limit equilibrium, probabilistic and finite difference
- computer analysis techniques

### Course Requirements:

Course Evaluation: The final grade in this class will be based upon:

- Attendance & class participation (25%)
- Exams & homework assignments (75%)

### Topics:

- |  |   |
|--|---|
| 1. Terminology                               | 9. Engineering rock mass classification schemes |
| 2. Landslide causes and processes            | 10. Hemispherical projection techniques         |
| 3. Economic consequences of slope failure    | 11. Limiting equilibrium                        |
| 4. Modes of rock slope failure               | 12. Planar failure                              |
| 5. Introduction to the probabilistic concept | 13. Toppling failure                            |
| 6. Engineering properties of discontinuities | 14. Wedge failure                               |
| 7. Groundwater                               | 15. Stabilization techniques                    |
| 8. Geologic data collection                  | 16. Computer applications                       |

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**Date:** September 2008



## MEM 464 - MINE DESIGN AND FEASIBILITY STUDY

### Required

MI223, MWF, 2:00 – 2:50 PM

#### Catalog Data:

MINE 431 - Underground Mine Design (3-1) 4 credits. Prerequisite: MEM 204, MEM 302, MEM 303, MEM 304, MEM 305, MEM 306, MEM 307 AND MEM 401. A complete mine feasibility study conducted as a senior design project. Students will have a choice of designing one of the following: a surface or underground coal mine, a quarry, a surface or underground hard rock mine, or sub-surface space (tunneling, large excavations, industrial/environmental underground storage site, or underground science laboratory). A comprehensive study of principles and practices involved in developing an ore deposit (surface or underground) starting with drill hole data following through with a complete feasibility study (based on financial returns on investments and sensitivity analysis) covering ore reserve calculations, and selection of mining methods and equipment. Computerized approach will be an integral part of the course: SurvCADD software and Vulcan software are available to use. In addition to a computerized model of the mine, a final written report and presentation in front of the class will be required.

#### Textbook:

None

#### References:

All previous mining engineering course notes, pertinent library resources, and manufacturers technical and product specifications.

#### Outcomes

- an ability to apply the knowledge of mathematics and engineering science to problems in mine design and planning,
- an ability to apply the knowledge of mining engineering fundamentals, relevant technologies as well as techniques, skills and tools needed in mine design, planning and mine operation, and
- an ability to develop problem solving capabilities and apply them in mine design, planning and mine operation.
- 

#### Course Requirements:

- Project progress 10%
- Oral presentation 25%
- Final design report 65%

#### Topics:

1. Requirements and scope
2. Mine Modeling
3. Reserves
4. Mine design algorithms and mining method selection
5. Introduction to the probabilistic concept
6. Development and production requirements
7. Drainage, power distribution and haulroads
10. Manpower, organization and management
11. Equipment selection
12. Surface facilities and infrastructure
13. Hydrology and dewatering
14. Cost estimation and economic analysis

#### Prepared By:

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#### Prepared:

January 2009



**MEM 466—Mine Management**  
**Required**  
**Meets MONDAYS, 8:00 – 10:50 in MI 320**

**Catalog Data:**

(2-0) 2 Credits – Prerequisites: None. Provide students with an understanding of critical management issues of fundamental importance to the mining industry. Develop students' leadership skills. Emphasize management of human resources, conflict resolution, negotiation skills and project management skills.

**Textbook:**

None

**References:**

Mostly class notes and guest speaker notes.

**Outcomes:**

Students completing this class will be able to demonstrate:

- the ability to use the techniques, skills and modern management tools necessary to function effectively in the mining environment as it related to managing resources, people and projects effectively.

**Course Requirements:**

Course Evaluation: The final grade in this class will be based upon:

- Attendance & class participation (80%)
- Exams & homework assignments (10%)
- Projects & accompanying reports (10%)

**Topics:**

- Background of modern management & functions in the management process
- Legal forms of management
- Planning, Organizational structures, Upper management
- Professionalism and ethics
- Project management and operation scheduling
- Mine safety management, equipment maintenance management
- Training and development of human resources
- Bargaining process, Risk management
- Computerized databases as a management tool

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**Date:** January 2009

