

**Mining Engineering**

**HANDBOOK FOR UNDERGRADUATE STUDENTS**

**UNIVERSITY OF KENTUCKY**

**August 2008**

**Department of Mining Engineering  
College of Engineering  
University of Kentucky  
Lexington, KY 40506-0107**

# HANDBOOK FOR UNDERGRADUATE STUDENTS IN MINING ENGINEERING

**Department of Mining Engineering  
University of Kentucky  
230 Mining and Mineral Resources Building  
Lexington, Kentucky 40506-0107**

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This handbook is a supplement to the official University Bulletin and is only for advice and interpretation. Official policy is only in the Bulletin, which students should consult. Information in this handbook applies to students who enter the program in the 2008/2009 academic year.

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## SECTION I: GENERAL INFORMATION

## SECTION I: GENERAL INFORMATION

### LOCATION

Lexington, only 80 miles south of Cincinnati on Interstate 75 and 83 miles east of Louisville on Interstate 64, is less than a one-day drive from all major metropolitan centers in the eastern and Midwestern areas of the country.

Because the University of Kentucky is located in Lexington, its Department of Mining Engineering has the advantage of being located at the center of the state that is one of the leading producers of coal. The benefits resulting from the dominance of its coal industry are seen further by its location midway between the Appalachian Coal Basin (Eastern Kentucky) and the Eastern Interior Coal Basin (Western Kentucky). Among mining people, Lexington is humorously referred to as the world's largest and finest coal camp.

The Lexington area is so rich in heritage that sightseeing is a major attraction, encompassing more than 200 years of living history. The presence of the University of Kentucky has enhanced the area, with a proliferation of functions ranging from the A.B. Chandler Medical Center to Rupp Arena, one of the world's largest basketball arenas, with a seating capacity of 23,000 fans. Kentucky's sports prowess is a matter of permanent record and is highly visible in the national sports archives. UK's football program continues to make strides and consistently vies for holiday bowl bids. Other significant features in Lexington include Transylvania University, the oldest institution of higher education west of the Allegheny Mountains; Lexington Theological Seminary; Kentucky Episcopal Seminary; and Ashland Baptist College. Lexington has the largest Community Concert Association in the country, where renowned artists and speakers appear regularly. Of great interest are the Lexington Philharmonic Orchestra, a strong chamber music series, the Lexington Ballet, and Arts Place. Lexington is also a strong theater town, served by several regular companies and various touring groups.

The climate is moderate with cool plateau breezes, cool summer nights, and no prolonged periods of heat, cold, rain, wind, or snow. Kentucky abounds in facilities that appeal to those who like the out-of-doors. Its outstanding system of State parks, together with the Daniel Boone National Forest, provide boating and associated water sports, fishing, hiking, camping and horseback riding. The famous Red River Gorge area of the Daniel Boone National Forest, a favorite of backpackers and canoeists, is only 50 miles by expressway from Lexington. Kentucky has good canoeing and white water rivers, and is famous for its caves and natural bridges. The Bluegrass region is one of the best areas in the United States for biking as it has a vast network of paved country roads from which to choose.

The optimal blending of the old with the new, together with the history, location, and resources available at the University of Kentucky, results in an ideal environment for the scholastic and professional development of the serious mining engineering student.

## DEPARTMENT OF MINING ENGINEERING

The University of Kentucky's Department of Mining Engineering has the distinction of being both among the oldest and newest programs of its type in the nation. It is one of the oldest in that the program was founded as the School of Civil and Mining Engineering in 1866; newest in that it was only 1982, after a varied history of change reflecting conditions in the mining industry, that the department was upgraded from a transition program in Civil Engineering to departmental status.

In 1910, a college was established and given the name Mines and Metallurgy, but seven years later the college was amalgamated into a department within the College of Engineering. In 1966 the mining department was realigned with Civil Engineering. In 1977, the University Board of Trustees authorized the reestablishment of Mining Engineering as a separate and distinct department. In 1988, the Department moved to the Mining and Mineral Resources Building.

In keeping with its history and the renewed emphasis of the University's commitment to mining engineering, a distinguished national and international faculty has been assembled. Hence, in a continuing pursuit for excellence, the University of Kentucky's traditional land-grant teaching, research, and service function is expanded further through the addition of faculty members recruited from among the world's finest mining programs. This faculty gives the Department of Mining Engineering an increased academic capability to become a leader in both the State's and the nation's minerals industry.

### STATEMENT OF CAPABILITIES

The Department of Mining Engineering at the University of Kentucky has been favored with an excellent faculty, a sufficiency of space, and an abundance of modern equipment. This document attempts to describe succinctly the Department's capabilities in research and development for the benefit of potential research collaborators and sponsors. In summary, the mining faculty has access to 25,259 square feet of space and to equipment with an original purchase value in excess of \$1.6 million. They are served by an elaborate but flexible computing network of personal computers and an integral bridge to the university computing environments.

Although described separately, the facilities of the UK Center for Applied Energy Research, CAER, are readily available to departmental researchers. A number of completed cooperative projects point to the open relationship between the Center and the Department. The CAER is a 60,000 square foot facility containing over \$7 million in process development and analytical equipment.

### FACULTY

The brief biographies that follow show the array of talents and interests possessed by the faculty members in mining engineering. More complete résumés are available for each individual.

Rick Q. Honaker (Ph.D., Virginia Polytechnic Institute and State University), Professor: mineral processing, coal preparation, and fine particle separation.

G.T Lineberry (Ph.D., West Virginia University), Professor: mine plant engineering; underground mining operations. Research interests include evaluation, selection, and design of mobile mine equipment; occupational safety and health; engineering education; operations research.

Braden T. Lusk (Ph.D., University of Missouri-Rolla), Assistant Professor: blasting, explosives, blast mitigation, public relations, mine operations and management.

B. K. Parekh (Ph.D., The Pennsylvania State University), Adjunct Professor: physical beneficiation, flotation, fine particle technologies, dewatering; surface, colloid, and solution chemistry. Research, at the Center for Applied Energy Research, includes basic and applied subjects for clean coal technology.

Joseph Sottile, Jr. (Ph.D., The Pennsylvania State University), Professor: mine electrical systems and monitoring and control. Research interests include condition-based maintenance of electrical machinery, fault diagnostics, and mine electrical system safety.

Richard J. Sweigard (Ph.D., The Pennsylvania State University, P. E.), Chairman and Professor: geotechnology, groundwater, soil reconstruction, surface mining. Research interests include soil compaction, differential settling of mine backfill, reclamation, and slope stability.

Daniel Tao (Ph.D., Virginia Polytechnic Institute and State University), Professor: mineral processing, coal preparation, surface chemistry. Research interests include fine particle separation, fine coal dewatering, column flotation, waste water treatment, and solid waste utilization.

Kot F. Unrug (D.Sc., Ph.D., Academy of Mining and Metallurgy, Krakow, Poland), Professor: underground construction, mine design, strata control. Research interests include broad aspects of applied rock mechanics; roof control; subsidence; field, scale model and laboratory testing.

Andrzej M. Wala (Ph.D., Academy of Mining and Metallurgy, Krakow, Poland), Professor: mine ventilation, mine electricity, elements of mining. Research interests include dynamics of flow in mine ventilation networks; monitoring and control of ventilation networks; expert systems applications in mining; dynamics of diesel exhaust gas concentrations in confined headings; industrial testing; and computer simulation.

## FACILITIES

The Mining and Mineral Resources Building, located on Rose Street near the center of campus, is a handsome and spacious structure that houses four principal occupants: The Kentucky Geological Survey, the Department of Mining Engineering, the Kentucky Water Resources Research Institute, and the coal group of the Department of Geological Sciences. Mining has approximately 42 percent of the assigned space in the building. Specifically, this is a total of 25,259 square feet of space, of which 14,106 is devoted to laboratories; 7,898 to offices, classrooms, and other non-laboratory space; and 3,255 is shared with other building occupants.

Laboratories are designated by their function; space exists for each major sub discipline of mining engineering: rock mechanics testing, rock mechanics modeling, ventilation, gas and dust, mine electrical systems, coal preparation unit operations, coal testing, microscopic analysis of surfaces, environment and geotechnology, and computation and design. In addition, there are suitable rock cutting and shaping facilities, mineral processing preparation areas, and field studies staging areas.

## LABORATORIES AND EQUIPMENT

### A. COAL AND MINERAL PREPARATION

Coal Drying Room: Controlled ovens that conform with ASTM standards for air drying of coal.

Analytical Laboratory: Ash analysis furnace, total sulfur analyzer, thermogravimetric analyzer, combustion vessel assembly, calorimeter, particle size analyzer, dynamic and static viscometers, goniometer, zeta potential analyzer, fume hood, microscopes.

Crushing, Grinding and Sample Preparation: Hardgrove grindability tester, hammer mill, Holmes 10 x 15 hammer-mill crusher, 5-inch by 6-inch jaw crusher, Chipmunk jaw crusher, riffle, ball mill, pro-splitter table and vibratory feeder, Gilson testing screens, Ro-tap sieve shakers, suitable sieves, sieve cleaner, gyratory screen separator, Draiswerke pulverizing system, holmes pulverizer, variety of scales and balances, Buehler polishing table.

Dust-generating equipment is appropriately enclosed and vented; equipment used on potentially explosive materials is shielded and sealed to guard against electrical spark.

Unit Processing Laboratory (wet): Deister table, Mozley table, 18 x 24 commercial jig, 4 x 6 jig, Carpcoc portable laboratory cyclone unit, Krebs dense medium cyclone system instrumented with data acquisition and computer control, Krebs and Multotec classifying cyclones, fluidized-bed separator, Franz isodynamic separator, wet magnetic separator, high tension electrostatic separator, triboelectric separator, flotation cells (Denver, Wemco, Hazen-Quinn), flotation columns, batch pressure filter, wet-vac wet sieve tester, air-jet sieve, centrifuge, batch vacuum filter, laboratory thickener, process control instrumentation, variety of mixers, sumps and pumps.

## B. ROCK MECHANICS

Testing: Satec stiff testing system, model C600MB, 300-ton capacity, configured for compressive testing; Satec stiff testing system, model TC-55, 25-ton capacity configured for both compressive and tensile testing (both machines are digitally controlled and have digital data acquisition systems); direct shear machine. Photoelastic apparatus with bi-axial chamber allows the studying of stresses under two-dimensional loading conditions.

Modeling: The modeling laboratory is built with a stiff floor that may be used as a resistance plate for large-scale testing of rock or support systems. The breech of a 16-inch naval battleship gun has been converted into a high-pressure triaxial chamber for rock specimens of up to one cubic foot.

Field Studies: Equipment readily available for field research includes instruments for stress determination monitoring of support performance, measurement of deformation and strain, borescoping and in situ testing of rock properties.

## C. VENTILATION

The laboratory devoted to mine ventilation is extremely well equipped for both, research and instruction. Therefore, the main goal of this laboratory is to give the student hands-on experience with ventilation instrumentation, and in addition to support instruction in ventilation theory. The laboratory has a series of wind tunnels, ducting and instrumentation for measuring airflow and air quality. A number of computer packages are available for comparing simulation output with laboratory experiences. These packages are sufficient for full-scale mine ventilation network analysis.

Airflow Studies: A low-turbulence wind tunnel with 400-mm by 400-mm measuring chamber, velocity range of 0-13 meters per second (for anemometers calibration); axial fan testing stand, including a 30-inch diameter wind tunnel, consisting of a 34-inch adjustable pitch axial fan, a 25-horsepower motor speed driver, with a computerized monitoring and control system, to allow for the remote monitoring of the fan performance and control of the fan speed and blade pitch; auxiliary tubing ventilation system consisting of 150 feet of reinforced 18-inch diameter tubing network combined with two 21-inch diameter auxiliary axial fans that can be connected in series or parallel; climatic simulation unit that demonstrates the sensitivity of psychrometric parameters of the underground environment; physical model of a mine ventilation network based on four inch plastic pipe (to perform ventilation survey); precision smoke tunnel. Face ventilation systems can be study using specially design scaled physical model equipped with the laser Particle Image Velocimetry (PIV) measuring system.

Airflow Measurements: Hot-wire anemometers, vane anemometers (both mechanical and electronic), Pitot tubes. Pressure: incline manometer, portable precision manometer (range of  $1.0 \text{ N/m}^2$ ). Absolute pressure: mechanical barometers (aneroids), electronic absolute pressure gauges.

Air Quality: Instrumentation is available for the following gasses: CO, CH<sub>4</sub>, O<sub>2</sub>; coal dust analysis: gravimetric, light-scattering miniram.

#### D. MINE ELECTRICAL SYSTEMS

The Mine Electrical Systems Laboratory is a 527-square-foot facility dedicated to both teaching and research of electrical engineering applications in the mining industry. Instructional use emphasizes the demonstration of operating principles of electrical and electronic devices commonly used in the mining industry, and safety aspects of mine electrical systems. Major instructional equipment is listed below

Universal Laboratory Machine: The Universal Laboratory machine (ULM) is a two-pole, uniform airgap universal machine directly coupled to a swinging frame DC dynamometer. The stator windings of the ULM are terminated on a panel at the front of the machine. This terminal panel makes it possible to form a large variety of phase and field windings by connecting the individual coils in different configurations. The dynamometer can be used as separately excited generator or as a field-controlled shunt motor.

Ground Fault Protection Demonstrator: The Ground Fault Protection Demonstrator is a fully functional ground fault protection system for both three-phase and single-phase systems. The demonstrator includes a three-pole circuit breaker equipped with a shunt trip device, current transformers, an electronic ground fault relay, instrument transformer, ammeters and a variable impedance fault. The demonstrator is used for demonstrating zero-sequence relaying, direct relaying, potential relaying, the effect of parallel paths and so forth.

AC Motor Controller: The AC motor controller includes devices necessary for demonstrating full-voltage starting, reduced-voltage starting, reversing and overload protection of three-phase induction motors.

DC Motor Controller: The DC motor controller includes devices necessary for demonstrating full and reduced voltage starting, adjustable-speed operation, dynamic braking, overload and field-failure protection.

Motor-Generator Set: The Motor-Generator set is composed of a 7.5 HP four-pole synchronous motor coupled to a 5.0 kW four-pole synchronous generator. The synchronous generator has been custom-built to provide access to 45 individual points within the armature winding and 9 different points in the field winding.

Programmable Logic Controllers: PLCs consist of two Allen Bradley SLC 5/03 programmable logic controllers, each with 16 inputs and 16 outputs. Five copies of RSLogix 500™ ladder logic programming software are available for the development of logical statements that can be downloaded to the SLC 5/03.

Miscellaneous: Voltage and current probes, digital multimeters, oscilloscope, tachometers, power supplies, motors, generators, transformers, control circuit panels, etc.

## E. ENVIRONMENT AND GEOTECHNOLOGY

Giddings soil probe equipped with recording cone penetrometer; frame, test tank, air pallet, and hydraulic ram for modeling ripper studies; nuclear density gauge; Geotest master triaxial permeability panel and triaxial load frame.

## F. EXPLOSIVE ENGINEERING

An underground explosives laboratory is located 25 miles from campus in Georgetown, Kentucky. The site is dedicated to both the advancement of explosives and their application to the mining industry, as well as, the testing of materials' reactions to blasts.

Testing Range: A Shock Tunnel used to simulate large-scale arena blasts is located at the underground laboratory. The laboratory also has a small-scale open-air arena, which is used to recreate scaled distance blast events.

High Speed Video: Two high-speed video cameras for visual inspection of explosive events. The primary, a Blaster Ranger HD camera capable of high definition color video and up to 16,000 frames per second. The secondary, a Red Lake camera with a max frame rate of 1,000 frames per second. MIDAS video software is used for image analysis.

Modeling: AUTODYN nonlinear explicit finite element program is licensed to two workstations. Explosive detonation events are modeled with this software.

Sensory Capabilities: A suite of PCB Piezoelectric reflected pressure sensors and PCB Piezoelectric free field pressure sensors are used to monitor the pressures produced from explosive events.

Data Acquisition: A MREL Data Trap and a MREL Micro Trap are employed for recording sensor signals in conjunction with a PCB signal conditioner. 12 channels of 10 MHz data acquisition are available.

Geophones: Two White Industrial Seismology seismographs are used for ground vibration and airblast data collection.

Field Studies: A PC backed Structural Response Network of geophones, accelerometers, and microphones capable of around the clock monitoring of a specific site. Currently installed in a house in West Virginia it is accessible at any time via DSL uplink.

## COMPUTING

### A. COMPUTER NETWORK

The Mining and Mineral Resources Building (MMRB) network consists of a Gigabit fiber backbone with individual office and lab connections being provided by 10/100 switches and hubs. As the needs and functions of the end user areas change and grow, the entire network is evolving into an all switched environment. MMRB's network is linked to the campus Gigabit core network by its own Gigabit uplink, and the whole, in turn, is linked to the Internet via a DS-3 (45Mbps) connection.

This arrangement allows students, faculty and staff to access network resources, such as databases, search engines, compute servers and license servers at the University or on the Internet as needed.

### B. STUDENT COMPUTING

#### Room 248 MMRB:

Six Dell Precision 390 computers,  
22" Monitor, Windows XP

Three Dell Optiplex 620 computers  
22" Monitor, Windows XP

One HP Design Jet 1050C Plotter

One HP 2500CM Professional Series Color Printer

One Lexmark Optra T420 Laser Printer

#### Room 245 MMRB:

Four Dell Optiplex computers  
17" Monitor, Windows XP

### C. GRADUATE STUDENT COMPUTING

Computing equipment for graduate students, located in graduate student offices includes:

Three Dell Pentium 4, 2.4GHz CPU, 512 MB RAM  
Windows XP, 17" Monitor

One Dell Pentium 4, 1.7GHz CPU, 768 MB RAM  
Windows XP, 17" Monitor

One Dell Pentium 3, 533 MHz CPU, 128MB RAM  
Windows 2000, 17" Monitor

Two Dell Pentium 3, 600MHz CPU, 128MB Ram  
Windows 2000, 17" Monitor

One Dell Pentium 3, 450MHz CPU, 384 MB RAM  
Windows 2000, 17" Monitor

One Dell Pentium 2, 400MHz CPU, 128 MB RAM  
Windows 2000, 17" Monitor

One Lexmark Optra Rt Laser Printer

One Lexmark Optra S 1620 Laser Printer

### D. COMPUTING SOFTWARE

In addition to general purpose tools (e.g., MS Office, AutoCAD, Matlab, Maple) several specialized applications are introduced in some of the Mining Engineering courses. These include:

- VNETPC. VNETPC is a Windows-based application designed to assist engineers in the planning of underground ventilation layouts. Program output includes branch airflows, frictional pressure drops, airway resistance, air power losses in airways, ventilation cost of each airway, fan(s) operating point, duties of regulators and boosters, and gas flows and concentrations in branches. This application is used in MNG 341 for design and analysis of ventilation systems.
- Power Tools™ for Windows. Power Tools™ for Windows (PTW) is an application designed to assist engineers in the development and analysis of electrical power systems. It conducts load-flow analysis, fault analysis, and motor starting analysis of three-phase electrical networks. In addition, there is a module to assist in protective relay coordination. This application is used in the MNG 511 design project in which students design a power system (excluding protective devices) for a typical mine.

- **SurvCADD.** SurvCADD is an add-on package to AutoCAD with special CAD and analytical tools for mine design and production planning. It is widely used by mining companies in the eastern U.S.
- **REAME.** REAME is a slope stability package that utilizes six different limit equilibrium slope stability analysis methods. It is capable of analyzing the stability of nonhomogeneous slopes under effective stress conditions for circular, planar, and composite slip surfaces. It considers both static and seismic loading and can be run in either 2-D or 3-D mode. It is used for the design of pit slopes and embankments in MNG 463.
- **ALPS.** "Analysis of Longwall Pillar Stability" (ALPS). ALPS is a program for use in the design of pillars for longwall mines. The ALPS method, which is embodied in the program, consists of three basic steps:
  1. Estimating the loading that will be applied to the pillars during all the phases of longwall mining;
  2. Estimating the load-bearing capacity of the longwall pillar system, and;
  3. Calculating "stability factors" (SF) by comparing the load to the load-bearing capacity.
- **ARMPS.** "Analysis of Retreat Mining Pillar Stability" (ARMPS) is a computer program for use in the design of pillars for room-and-pillar retreat mining. ARMPS calculates stability factors (SF) based on estimates of the loads applied to, and the load-bearing capacities of pillars during retreat mining operations.
- **CMRR.** The Coal Mine Roof Rating (CMRR) program is a roof classification system that was first introduced to the mining community in 1994. The computer program developed by NIOSH is used for use in estimating the relative inherent strength of coal mine roof.
- **APEX.** APEX is a program used for economic evaluation of mining projects. It computes present value, payback period, rate of return and performs breakeven analysis, and risk and sensitivity analyses.

**SECTION II:**

**PROGRAM OBJECTIVES,  
LEARNING OUTCOMES AND CURRICULUM**

## SECTION II: PROGRAM OBJECTIVES, LEARNING OUTCOMES AND CURRICULUM

### MISSION OF THE DEPARTMENT OF MINING ENGINEERING

The Department of Mining Engineering at the University of Kentucky provides knowledge necessary for the mineral industries to serve the public in an economical, safe, and environmentally responsible manner. This is accomplished by the preparation of students for professional practice, the development of new knowledge through research, and the transfer of knowledge to industry. The department fosters an environment that emphasizes independent thought, professionalism, stewardship of mineral resources, and strong relationships with other constituents both within and outside the University community.

### PROGRAM OBJECTIVES

The objectives of the undergraduate program in mining engineering take into consideration the intellectual and personal development of students so that after graduation they will be able to:

- Advance in their careers, adapting to new situations and emerging problems, through the application of general purpose engineering skills and the core technical disciplines, analytical procedures, and design practices of the mining engineering profession.
- Function ethically in a variety of professional roles such as mine planner, designer, production manager, mineral processing engineer, consultant, technical support representative and regulatory specialist with emphasis on the mineral industries of Kentucky and the surrounding region.
- Pursue advanced degrees in mineral-related fields and also those fields that support the mineral industries such as business and law.
- Utilize professional skills such as effective communication, teamwork, and leadership.
- Demonstrate an understanding of the critical role mining engineers play in society with respect to health, safety, and the environment in tangible ways such as achieving professional licensure.

## PROGRAM LEARNING OUTCOMES

The Department of Mining Engineering has eleven program learning outcomes listed below:

- (a) An ability to apply knowledge of mathematics, science, and engineering,
- (b) An ability to design and conduct experiments, as well as to analyze and interpret data,
- (c) An ability to design a system, component, or process to meet desired needs,
- (d) An ability to function on multi-disciplinary teams,
- (e) An ability to identify, formulate, and solve engineering problems,
- (f) An understanding of professional and ethical responsibility,
- (g) An ability to communicate effectively,
- (h) The broad education necessary to understand the impact of engineering solutions in a global and societal context,
- (i) A recognition of the need for, and an ability to engage in lifelong learning
- (j) A knowledge of contemporary issues, and
- (k) An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

## ADVISING

The Department of Mining Engineering wants its students to succeed both academically and in extracurricular ventures. To this end, faculty serve willingly as advisors. Each student is assigned a faculty member with whom the student should consult on course and elective selection, scheduling and registration, grades and academic record, as well as broader issues of life at the University of Kentucky, cooperative work experiences, and post-baccalaureate careers or graduate school. Your advisor is assigned to you for the duration of your college career.

The student should have a friendly relationship with his or her advisor. Stopping by to see your advisor, both when there are problems and when there are successes, is encouraged. Respect your advisor's office hours, however; if he is out of his office then leave a message for him with the receptionist. If a problem is urgent, the receptionist should be able to find someone else to help you. In the unlikely event that you do not get along with your advisor, ask the Department Chairman to reassign you.

The student must remember that ultimately he or she is responsible for the successful completion of his or her program. Each student must learn the rules and requirements of the program; advisors and guidance material are meant to assist the student. Do not be trapped into extra unnecessary coursework or semesters because advice was not sought in a timely fashion.

**CURRICULUM LEADING TO THE  
BACHELOR OF SCIENCE DEGREE IN MINING ENGINEERING**

**FRESHMAN YEAR**

**FIRST SEMESTER**

CHE 105 General College Chemistry I	3
CS 221 First Course in Comp. Sci. for Engineers	2
ENG 104 Writing: an Accelerated Found. Course	4
MA 113 Calculus I	4
MNG 101 Introduction to Mng. Engr.	1
* University Studies	3
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	17

**SECOND SEMESTER**

CHE 107 General College Chemistry II	3
MA 114 Calculus II	4
MNG 264 Mining Methods	3
PHY 231 Gen University Physics	4
PHY 241 Gen. University Physics Laboratory	1
	<hr/>
	15

**SOPHOMORE YEAR**

**FIRST SEMESTER**

EM 221 Statics	3
GLY 220 Principles of Physical Geology	4
MA 213 Calculus III	4
MNG 331 Explosives and Blasting	2
PHY 232 General University Physics	4
PHY 242 Gen. University Physics Laboratory	1
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	18

**SECOND SEMESTER**

COM 199 Presentational Communication Skills	1
EM 302 Mechanics of Deformable Solids	3
MA 214 Calculus IV	3
ME 220 Engineering Thermodynamics I	3
MNG 291 Mineral Reserve Modeling	2
MNG 303 Deformable Solids Laboratory	1
MNG 332 Mine Plant Machinery	3
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	16

**JUNIOR YEAR**

**FIRST SEMESTER**

EE 305 Electrical Circuits and Electronics	3
GLY 230 Fundamentals of Geology I	3
ME 330 Fluid Mechanics	3
MNG 211 Mine Surveying	2
MNG 301 Minerals Processing	3
MNG 302 Minerals Processing Laboratory	1
MNG 371 Professional Dev. of Mining Engineers	3
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	18

**SECOND SEMESTER**

ECO 201 Principles of Economics I	3
EM 313 Dynamics	3
MNG 335 Intro. to Mine Systems Analysis	3
MNG 463 Surface Mine Design and Env. Issues	3
*** Minerals Processing Technical Elective	3
* † University Studies/Graduation Writing Req.	3
	<hr/>
	18

**SENIOR YEAR**

**FIRST SEMESTER**

MNG 341 Mine Ventilation	3
MNG 431 Mine Sys. Engineering and Valuation	4
MNG 551 Rock Mechanics	4
MNG 591 Mine Design Project I	1
* University Studies	3
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	15

**SECOND SEMESTER**

MNG 592 Mine Design Project II	3
** Supportive Elective	3
†† Technical Elective	3
†† Technical Elective	3
* University Studies	3
	<hr/>
	15

Total hours = 132

\* Selected from University Studies areas in Social Sciences (6 credits), Humanities (6 credits), and Cross-Cultural (3 credits) in consultation with academic advisor. Of these totals, 3 credits of Social Sciences are fulfilled by ECO 201. A minimum of 15 hours in the humanities and social sciences are required.

\*\* The supportive elective is to be chosen from any University course outside the student's major excluding more elementary versions of required courses such as precalculus mathematics.

\*\*\* The Minerals Processing Technical Elective is to be chosen between MNG 575 – Coal Preparation Design and MNG 580 – Mineral Processing Plant Design.

† The course selected to fulfill the Graduation Writing requirement can also be used to satisfy the Cross Cultural requirement or 3 credits of the Humanities requirement. Selection of ENG 264 will satisfy the Graduation Writing Requirement and the Cross-Cultural requirement. Alternatively, selection of one course from among ENG 230, ENG 231, ENG 232, ENG 233, ENG 234, ENG 261, ENG 262, ENG 270, or ENG 271 will satisfy the Graduation Writing requirement and 3 credits of the Humanities requirement. Please consult the Schedule of Classes for updates to the list of courses.

†† Courses recommended as technical electives are listed below. These courses must be chosen with the approval of the student's advisor to ensure that the curriculum includes sufficient engineering design content.

Technical Electives. Of the two technical electives in the undergraduate program, students are required to select at least one from departmental courses. The remaining course, chosen with the approval of the student's advisor, can be used to fulfill specific educational goals.

MNG 511 Mine Power System Design  
MNG 561 Mine Construction Engineering I  
MNG 563 Simulation of Industrial Production Systems  
MNG 575 Coal Preparation Design  
MNG 580 Mineral Processing Plant Design  
MNG 599 Topic in Mining Engineering  
BAE 438G Fundamentals of Groundwater Hydrology  
CE 441 Fluid Mechanics II  
CE 471G Soil Mechanics  
GLY 450G Sedimentary Geology  
GLY 585 Hydrogeology  
PLS 501 Reclamation of Disturbed Land

## MINING ENGINEERING DEGREE CHECKLIST

Semester \_\_\_\_\_

Student Name \_\_\_\_\_

Subject Area	Course	Transfer and Selected Courses	Credits	Grade
Communication 8 credits	ENG 104		4	
	(Select) <sup>1</sup>		(3)	
	COM 199 <sup>2,3</sup>		1	
Mathematics 15 credits	MA 113 <sup>2</sup>		4	
	MA 114		4	
	MA 213		4	
	MA 214		3	
Basic Sciences (Natural Sciences) 23 credits	CHE 105 <sup>2</sup>		3	
	CHE 107 <sup>2</sup>		3	
	GLY 220		4	
	GLY 230		3	
	PHY 231		4	
	PHY 232		4	
	PHY 241		1	
	PHY 242		1	
Foreign Language 6 credits (or 2 years H.S.)			(3)	
			(3)	
Social Sciences 6 credits	ECO 201 <sup>2</sup>		3	
	(Select) <sup>2,4</sup>		3	
Humanities 6 credits	(Select) <sup>2,4</sup>		3	
	(Select) <sup>2,4</sup>		3	
Cross-Cultural 3 credits	(Select) <sup>2,4</sup>		3	

Engineering Sciences (4) 19 credits	ME 330		3	
	EE 305		3	
	EM 221		3	
	EM 302		3	
	MNG 303		1	
	EM 313		3	
	ME 220		3	
Major Courses 50 credits	MNG 101		1	
	MNG 211		2	
	MNG 264		3	
	MNG 291		2	
	MNG 301		3	
	MNG 302		1	
	MNG 331		2	
	MNG 332		3	
	MNG 335		3	
	MNG 341		3	
	MNG 371 <sup>2,3</sup>		3	
	MNG 431		4	
	MNG 463		3	
	MNG 551		4	
	MNG 591		1	
	MNG 592 <sup>2,3</sup>		3	
	Min. Proc. Tech Elec. <sup>7</sup>		3	
	Technical Elective <sup>2,5</sup>		3	
	Technical Elective <sup>5</sup>		3	
Other Courses Required by the Major 5 credits	CS 221		2	
	Supportive Elective <sup>2,6</sup>		3	
<b>TOTAL CREDITS</b>			132	

FOOTNOTES:

- <sup>1</sup> Select from ENG 230, ENG 231, ENG 232, ENG 233, ENG 234, ENG 261, ENG 262, ENG 270, or ENG 271 to satisfy 3 credits of the 6 credit Humanities requirement. Alternatively, choose ENG 264 to fulfill the Cross-Cultural requirement.
- <sup>2</sup> University Studies course.
- <sup>3</sup> MNG 371 Professional Development of Mining Engineers (three credits) and 592 Mine Design Project II (three credits) provide two additional credits of oral communication.
- <sup>4</sup> See University and Departmental rules on selecting University Studies courses.
- <sup>5</sup> Of the two technical electives provided in the undergraduate program, students are required to select at least one from departmental courses. The remaining course, chosen with the approval of the student's advisor, should be used to enhance specific educational goals.
- <sup>6</sup> The supportive elective is to be chosen from any university course outside the student's major excluding more elementary versions of required courses, such as precalculus mathematics.
- <sup>7</sup> Choose between MNG 575 – Coal Preparation Design and MNG 580 – Mineral Processing Plant Design.

## UNIVERSITY STUDIES PROGRAM

### A. PURPOSE

The University Studies program is designed to give the student the elements of education essential to a university degree. You will notice that the University Studies requirements include math, foreign language, inference-logic, written and oral communication, natural sciences, social sciences, humanities, cross-cultural, and electives. The University Studies requirements keep your education from becoming one dimensional, narrow, or excessively parochial. The student is encouraged to study these requirements well so as to obtain maximum benefit from the courses selected.

### B. SOME CONSTRAINTS

The selection of University Studies courses has a number of constraints. In the University Bulletin, for Area I, Math, the requirement is met by MA 113. In Area II – Foreign Language, the student must present evidence of two years of study of a foreign language in high school or take a two-course sequence in a single foreign language. In Area III – Inference-Logic, the requirement is met by MA 113. In Area IV – Written Communication, the requirement is met by ENG 104, or a score of 32 or above on the English component of the ACT, or a score of 700 or above on the SAT I – Verbal, or a score of 4 or 5 on the AP English Language Exam. There is also a Graduation Writing Requirement that is strictly not part of the University Studies Program that must be met. This requirement is fulfilled by completing one of the approved courses listed on page 75 of the 2008-2009 Bulletin. The student should be careful to select a course that also satisfies either the cross cultural requirement or 3 credits of the humanities requirement. In Area V – Oral Communication, the requirement is met by taking COM 199 (one credit) plus MNG 371 and MNG 592, each containing one credit of oral communication. Note that the oral communication requirement has been suspended from the University Studies requirement; however, COM 199 is still a program requirement and must be completed by students. In Area VI – Natural Sciences, the requirement is met by CHE 105 and CHE 107. In Area VII – Social Sciences, the student is required to take two courses in separate disciplines from a list of social science courses. This requirement can be met by taking ECO 201 plus one other course, excluding another economics course, from the list of approved social sciences courses. The humanities requirement, Area VIII, is met by taking six credits from among the approved humanities courses. In Area IX – Cross-Cultural, the requirement is met by taking one of the approved cross-cultural courses. Finally, Area X – Electives, is met by the one of the technical electives plus the supportive elective.

### C. COURSE SELECTION

Review the University Studies Program before attempting to select courses; they are in the University Bulletin and the Semester Schedule. Know your own interests and select courses accordingly. Remember, the rules represent minima; nothing but time constraints prevents the student from taking additional coursework.

- i. Math. Satisfied by MA 113.
- ii. Foreign Language. If you have not had a foreign language for a minimum of two years in high school, then you must take at least one year (two-course sequence) of a foreign language in addition to the published degree requirements.
- iii. Inference-Logic. Satisfied by MA 113.
- iv. Written Communication. Satisfied by ENG 104.  
Graduation Writing Requirement. Although the Graduation Writing Requirement is not part of the University Studies Program, it is a requirement for graduation (see page 7 of the 2008-2009 University Bulletin). Students should be careful to select a writing course that can also be used to fulfill the Cross-Cultural requirement or partially satisfy the Humanities requirement.  
To fulfill the Cross Cultural requirement, choose ENG 264.  
To partially fulfill the Humanities requirement choose from among ENG 230, ENG 231, ENG 232, ENG 233, ENG 234, ENG 261, ENG 262, ENG 270, ENG 271.
- v. Oral Communication. The sequence of COM 199, MNG 371, and MNG 592 contains three credits of oral communication. Note that although the Oral Communication requirement has been suspended, the Mining Engineering program still requires the completion of COM 199.
- vi. Natural Sciences. Satisfied by CHE 105 and CHE 107.
- vii. Social Sciences. Satisfied by ECO 201 plus one additional course from approved list, excluding another economics course.
- viii. Humanities. Satisfied by six credits of courses from the Humanities list.
- ix. Cross-Cultural. Satisfied by one course from the Cross-Cultural list.
- x. Electives. Satisfied by one Technical Elective plus the Supportive Elective. The Supportive Elective is to be chosen from any university course outside the student's major excluding more elementary versions of required courses, such as precalculus mathematics.

The student should be aware that not all courses listed in the University Bulletin are offered every semester. The courses listed in bold-faced type in the University Studies Program section of the Schedule of Classes are offered during that semester.

## SELECTING SUPPORTIVE AND TECHNICAL ELECTIVES

### A. SUPPORTIVE ELECTIVE

The supportive elective allows students to explore new subjects or to expand upon familiar ones. Courses for the supportive elective may be chosen from any major in the University. The Department of Mining Engineering encourages the student to obtain every benefit possible from this selection; consideration should be given to career goals, special talents, or subjects that have been enjoyed in earlier courses. The only specific prohibition excludes courses, such as precalculus mathematics, that are more elementary than those required for the major.

### B. TECHNICAL ELECTIVES

- i. Minerals Processing Technical Elective. The student is required to take one minerals processing technical elective, either MNG 575 – Coal Preparation Design or MNG 580 – Mineral Processing Plant Design.
- ii. Technical Electives. The student is required to take two additional technical electives. One of these courses must be offered by the Mining Engineering Department; the other course may be outside the department but must be selected from the following list, or with consent of the advisor. (Note that the second technical elective may be a second Mining Engineering elective.) In choosing these courses, the student should establish a theme that becomes an informal concentration such as minerals processing, underground coal mining, surface mining, ventilation, mine power systems, and so on.

#### Mining Engineering Courses

MNG 511 – Mine Power System Design  
MNG 561 – Mine Construction Engineering I  
MNG 563 – Simulation of Industrial Production Systems  
MNG 575 – Coal Preparation Design  
MNG 580 – Mineral Processing Plant Design  
MNG 599 – Topic in Mining Engineering

#### Other Technical Electives

BAE 438G – Fundamentals of Groundwater Hydrology  
CE 441 – Fluid Mechanics II  
CE 471G – Soil Mechanics  
GLY 450G Sedimentary Geology  
GLY 585 – Hydrogeology  
PLS 501 – Reclamation of Disturbed Lands

## ENGINEERING STANDING

Admission to engineering standing in mining engineering is necessary to be granted a baccalaureate degree in mining engineering. Students must complete 30 of the last 36 hours of their programs in residence at the University. The criteria for obtaining engineering standing in mining engineering are listed below. The same criteria are applied to transfer students.

Engineering standing criteria. Completion of a minimum of 35 semester hours acceptable towards the degree in mining engineering with a minimum cumulative grade-point-average (GPA) of 2.50. Completion of ENG 104, MA 113, MA 114, MA 213, CHE 105, and PHY 231, with a minimum cumulative GPA of 2.50 in these courses. University repeat options may be utilized as appropriate. Students who do not meet these GPA requirements may request consideration based upon departmental review if both of these GPA values are 2.25 or greater.

Many of the courses in the mining engineering curriculum require engineering standing as a prerequisite for registration in that course. These include:

- MNG 341 – Mine Ventilation
- MNG 371 – Professional Development of Mining Engineers
- MNG 395 – Independent Work in Mining Engineering
- MNG 431 – Mine Systems Engineering and Valuation
- MNG 463 – Surface Mine Design and Environmental Issues
- MNG 511 – Mine Power System Design
- MNG 551 – Rock Mechanics
- MNG 561 – Mine Construction Engineering I
- MNG 563 – Simulation of Industrial Production Systems
- MNG 575 – Coal Preparation Design
- MNG 580 – Mineral Processing Plant Design
- MNG 581 – Geostatistics
- MNG 591 – Mine Design Project I
- MNG 592 – Mine Design Project II
- MNG 599 – Topic in Mining Engineering

## LIST OF MINING ENGINEERING COURSES

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 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.

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.

MNG 291 Mineral Reserve Modeling (2)

Basic CAD drawing skills including drawing tools, basic dimensioning, coordinate systems, and crosshatching; concepts and approaches for estimation of spatial distribution of rock and mineral properties from sample data. The course emphasizes hands-on experience with mine design software for reserve estimation. Lecture, one hour; laboratory, two hours per week. Prereq: MNG 264

MNG 301 Minerals Processing (3)

Petrographic structure of ore and coal deposits, sampling theory, and particle motion in fluid streams. Unit operations for processing particulate materials; breaking, screening, laundering, froth flotation and clarification. Flowsheets, process selection and plant performance. Prereq: PHY 232, CHE 105.

MNG 302 Minerals Processing Laboratory (1)

Application of 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 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, CHE 105, PHY 231.

- MNG 332 Mine Plant Machinery (3)
- Theory and practice of mine haulage, hoisting, 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.
- 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: ME 330 and engineering standing.
- 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. Prereq: COM 199, engineering standing.
- MNG 374 Mine Valuation and Investment Analysis (3)
- Economic evaluation methods and applications to economic decision problems encountered in the mining industry, including the mine valuation problem. Prereq: MNG 264, MNG 301, STA 381, 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 Mine Systems Engineering and Valuation (4)
- Characterization and analysis of mine production systems, including economic considerations. Topics include basic production systems concepts, work sampling, standard time models, scheduling, PERT/CPM, engineering economics, mine valuation. Prereq: MNG 332, MNG 335, engineering standing.
- MNG 463 Surface Mine Design & Environmental Issues (3)
- Pit layout and design of excess spoil disposal areas including stability of the slopes. Design of sediment control systems to satisfy surface mine regulations. Use of design standards for various reclamation alternatives. Prereq: MNG 264, engineering standing.
- 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 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 230 and engineering standing.
- MNG 561 Mine Construction Engineering I (3)
- Development of underground capital openings (shafts, chambers, tunnels, and drifts) in mines. Design and construction under normal conditions. Organization and management of construction operations. Prereq: MNG 551.

- 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 572      Advanced Coal Preparation (3)
- Study of economic and environmental factors in cleaning a specific coal, laboratory tests for process selection, laboratory testing of alternative procedures leading to design of plant. Lecture, two hours; laboratory, three hours per week. Prereq: MNG 301 and engineering standing.
- 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, MNG 302, engineering standing.
- MNG 581      Geostatistics (3)
- The geostatistics approach for estimating the spatial distribution of rock and mineral properties. Topics include treatment of the spatial distribution of ore grade as regionalized variables, covariance stationary processes, variograms, volume/variance relations, ordinary kriging, block grade distributions, and nonlinear kriging approaches. Prereq: STA 381, engineering standing.
- MNG 591      Mine Design Project I (1)
- Students will undertake a design project consisting of reserve analysis of a given mine property. They will calculate minable reserves and analyze mining and quality properties of coal. Each student will write a report supported by maps and will present it orally before a group of peers and invited experts. Lecture, one hour; laboratory, one hour per week. Prereq: MNG 291 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. Lecture, two hours; laboratory, two hours per week. 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 634 Advanced Mine Engineering (3)
- Procedures and methods of obtaining data and analyzing mine systems for efficient development and exploitation of a mining property. Course includes applications of operation research techniques. Prereq: CE 555, CS/MA/STA 482G.
- MNG 637 Rock Slope Stability and Design (3)
- Design and stability analysis of rock slopes using analytical, empirical, and numerical approaches, engineering geological data, groundwater pressure, blasting, and remedial measures. Prereq: MNG 551.
- 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 681      Geostatistics II (3)
- A second course in geostatistics for mine planning and geotechnical applications. Topics include co-regionalized variables and co-kriging, non-parametric geostatistics (indicator, probability, and soft kriging), loss functions and optimum predictors for ore selection decisions, conditional simulation techniques and applications. Prereq: MNG 681.
- MNG 690      Advanced Mineral Beneficiation Engineering (3)
- State-of-the-art techniques in mineral beneficiation and their application in coal and mineral preparation industry. Prereq: MNG 301 and MNG 572.
- MNG 691      Simulation of Mineral Processing Circuits (3)
- Flow-sheet 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.

**SECTION III:**

**U.K. MINING ENGINEERING CO-OP PROGRAM**

### SECTION III: U.K. MINING ENGINEERING CO-OP PROGRAM

Numerous co-operative training opportunities are available between the mining industry and Kentucky mining engineering students. These programs offer on-the-job training, with a steady income, to students who elect to co-op. Typically, a student will take a minimum of five years to complete the program, while spending alternate periods of the spring, summer and fall academic year in industry. Co-op programs are arranged between the student and the sponsoring company. Admission to the College of Engineering is a requisite for entering the program. These programs offer excellent training opportunities and provide a basis for long-term employment, should the co-op prove to be mutually compatible between the student and the sponsoring company. Experience shows that it is frequently desirable for two co-op students to alternate with a given sponsor so that living quarters at the University of Kentucky and in the location of the sponsoring company can be shared. Hence, when one student is in school, the other student is working.

In addition to the student's mining engineering advisor, help with co-op education can be obtained from the College of Engineering Co-op Education Office, (859) 257-4178. Additional details can be found at the COE Co-op website, <http://www.engr.uky.edu/coop/index.html>.

#### UK MINING ENGINEERING CO-OP CLASS/WORK SCHEDULE OPTIONS

##### THREE WORK TOURS

YEAR	GRADE	SEMESTER		
		FALL	SPRING	SUMMER
1	Freshman	Class	Class	Vacation
2	Sophomore	Class	Class	Vacation
3	Junior 1	Class	Work	Class
4	Junior 2	Work	Class	Work
5	Senior	Class	Class	UK Alum

##### FOUR WORK TOURS

YEAR	GRADE	SEMESTER		
		FALL	SPRING	SUMMER
1	Freshman	Class	Class	Vacation
2	Sophomore	Class	Class	Work
3	Junior 1	Class	Work	Class
4	Junior 2	Work	Class	Work
5	Senior	Class	Class	UK Alum

FIVE WORK TOURS

YEAR	GRADE	SEMESTER		
		FALL	SPRING	SUMMER
1	Freshman	Class	Class	Class
2	Sophomore	Work	Class	Work
3	Junior	Work	Class	Work
4	Senior 1	Class	Class	Work
5	Senior 2	Class	UK Alum	UK Alum

\*In order to retain full-time status, registration for EGR 399 is required. This one-hour pass/fail course allows the co-op office to act on behalf of the student in matters related to pre-registration, housing, ID validation and other activities. Up to three hours may be applied toward the supportive elective requirement.

**SECTION IV:**

**FINANCIAL AID APPLICATION AND INFORMATION**

UNIVERSITY OF KENTUCKY  
SCHOLARSHIP AND FINANCIAL AID APPLICATION  
KENTUCKY MINING ENGINEERING SCHOLARSHIP

Name: \_\_\_\_\_ Home Phone Number: \_\_\_\_\_

Address: \_\_\_\_\_ City: \_\_\_\_\_ State: \_\_\_\_\_ Zip: \_\_\_\_\_

County: \_\_\_\_\_ Date of Birth: \_\_\_\_\_ UK Student ID Number:   9  

Email: \_\_\_\_\_ Cell Phone: \_\_\_\_\_ Circle Grade: 9 10 11 12

**Minimum Scholarship Requirements for freshmen entering into the Mining Engineering Program**

LEVEL	GPA	ACT COMP.	ACT MATH	AMT./YEAR
I	3.5 - 4.0	29 - 36	30 - 36	\$5,000
II	3.0 - 3.49	26 - 28	27 - 29	\$4,500
III	2.5 - 2.99	23 - 25	25 - 26	\$4,000
IV	2.5 - 2.99	21 - 22	23 - 24	\$2,600

The Mining Engineering Scholarship Program supports students who are full time students in mining engineering. No one pursuing a double major will be considered. To continue receiving KMES funding you must be enrolled full time in the Mining Engineering Program, making satisfactory progress toward your degree and maintain the following GPA's:

LEVEL	GPA	MATH, CHEM. & PHYSICS GPA	AMT./SEMESTER
I	3.6 - 4.00	3.20 - 4.00	\$2,500
II	3.3 - 3.59	3.00 - 3.19	\$2,250
III	3.0 - 3.29	2.50 - 2.99	\$2,000
IV	2.7 - 2.99	2.25 - 2.49	\$1,300

Total income expected per semester. Exclude summer employment earnings: \_\_\_\_\_

**Guidance Counselor Recommendation:**

Name: \_\_\_\_\_ Address: \_\_\_\_\_

High School: \_\_\_\_\_ Phone: \_\_\_\_\_ Email: \_\_\_\_\_

I hereby grant permission to the KMES Director and to the chairman, Dept. of Mining Engineering, to reveal all or part of the above information to any concerned officials, committees or boards of the University of Kentucky and to any financial grantors.

Applicant Signature: \_\_\_\_\_ Date: \_\_\_\_\_

High school seniors should include ACT/SAT scores, transcripts, rank in class, and GPA. Transfer students with 12 credit hours or more should submit a transcript from the last college attended with application.

Mail / Fax To: Director, Kentucky Mining Engineering Scholarship      Fax: 859 323 - 1962  
230 Mining & Mineral Resources Building  
University of Kentucky  
Lexington, Ky. 40506 - 0107      Phone: 859 257 - 8032

**MINIMUM REQUIREMENTS  
FOR KMES SCHOLARSHIP PROGRAM**

- A. Freshman admitted for enrollment at the University of Kentucky, Department of Mining Engineering, must meet the following requirements:**
1. **Mining Engineering Scholarship - Level I** \$2500/5000  
- High School G.P.A. of 3.50 or greater, including a minimum of 29 Composite and 30 Math A.C.T. scores or S.A.T. equivalents.
  2. **Mining Engineering Scholarship - Level II** \$2250/4500  
- High School G.P.A. between 3.00 and 3.49, including a minimum of 26 Composite and 27 Math A.C.T. scores or S.A.T. equivalents.
  3. **Mining Engineering Scholarship - Level III** \$2000/4000  
- High School G.P.A. between 2.50 and 2.99, including a minimum of 23 Composite and 25 Math A.C.T. scores or S.A.T. equivalents.
  4. **Mining Engineering Scholarship - Level IV** \$1300/2600  
- High School G.P.A. between 2.50 and 2.99, including a minimum of 21 Composite and 23 Math A.C.T. scores or S.A.T. equivalents.
- B. College transfer admitted for enrollment at the University of Kentucky, Department of Mining Engineering, must meet the following requirements:**
1. **Mining Engineering Scholarship - Level I** \$2000 per semester  
- A cumulative G.P.A. of 3.60 or greater in a minimum of 24 credit hours, including a G.P.A. of 3.20 in a minimum of 10 credit hours of math, chemistry, physics, and English courses applicable to the degree program in Mining Engineering.  
- Students not meeting the above requirements for minimum credit hours must meet the requirements for entering freshman.
  2. **Mining Engineering Scholarship – Level II** \$1700 per semester  
A cumulative G.P.A. of 3.0-3.59 or greater in a minimum of 24 credit hours, including a G.P.A. of 2.75 in a minimum of 10 credit hours of math, chemistry, physics, and English courses applicable to the degree program in Mining Engineering.  
- Students not meeting the above requirements for minimum credit hours must meet the requirements for entering freshman.
  3. **Mining Engineering Scholarship – Level III** \$1300 per semester  
- A cumulative G.P.A. between 2.70 and 2.99 in a minimum of 24 credit hours, including a G.P.A. of 2.25 in a minimum of 10 credit hours of math, chemistry, physics, and English courses applicable to the degree program in Mining Engineering.  
- Students not meeting the above requirements for minimum credit hours must meet the requirements for entering freshman.
- C. UK Mining Engineering returning students who have completed fewer than 69 credit hours in the Mining Engineering Curriculum as that curriculum specified upon their enrollment in the Mining Engineering Department must meet the following requirements:**
1. **Mining Engineering Scholarship - Level I** \$2500/5000  
- A cumulative G.P.A. of 3.60 or greater, including a minimum G.P.A. of 3.20 in math, chemistry, physics and English courses applicable to the degree program in Mining Engineering.
  2. **Mining Engineering Scholarship - Level II** \$2250/4500  
- A cumulative G.P.A. between 3.30 and 3.59 and a minimum G.P.A. of 3.00 in math, chemistry, physics and English courses applicable to the degree program in Mining Engineering.
  3. **Mining Engineering Scholarship - Level III** \$2000/4000  
- A cumulative G.P.A. between 3.00 and 3.29 and a minimum G.P.A. of 2.50 in math, chemistry, physics and English courses applicable to the degree program in Mining Engineering.

4. **Mining Engineering Scholarship - Level IV** \$1300/2600  
 - A cumulative G.P.A. between 2.70 and 2.99 and a minimum G.P.A. of 2.25 in math, chemistry, physics and English courses applicable to the degree program in Mining Engineering.
- D. UK Mining Engineering returning students who have completed 69 or more credit hours in the Mining Engineering Curriculum as that curriculum was specified upon their enrollment in the Mining Engineering Department must meet the following requirements\*\*.**
1. **Mining Engineering Upperclassman Scholarship - Level I** \$3800 per semester  
 - A cumulative G.P.A. 3.60 or greater, including a minimum G.P.A. of 3.20 in math, chemistry, physics, and English courses applicable to the degree program in Mining Engineering.
2. **Mining Engineering Upperclassman Scholarship - Level II** \$3400 per semester  
 - A cumulative G.P.A. between 3.30 and 3.59 including a minimum G.P.A. of 3.0 in math, chemistry, physics and English courses applicable to the degree program in Mining Engineering.
3. **Mining Engineering Upperclassman Scholarship - Level III** \$3000 per semester  
 - A cumulative G.P.A. between 3.00 and 3.29 including a minimum G.P.A. of 2.50 in math, chemistry, physics and English courses applicable to the degree program in Mining Engineering.
4. **Mining Engineering Upperclassman Scholarship - Level IV** \$2300 per semester  
 - A cumulative G.P.A. between 2.70 and 2.99 and a minimum G.P.A. of 2.25 in math, chemistry, physics and English courses applicable to the degree program in Mining Engineering.
5. **Mining Engineering Upperclassman Scholarship - Level V** \$1400 per semester  
 - A cumulative G.P.A. between 2.50 and 2.69 and a minimum G.P.A. of 2.25 in math, chemistry, physics and English courses applicable to the degree program in Mining Engineering.
- E. Pre-mining engineering students at other Kentucky Community Colleges must meet the following requirements:**
- Mining Engineering Scholarship** \$900 per semester  
 Students must be registered in courses suitable for transfer into the mining engineering program.

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 \*Funding for scholarships is provided principally by the Coal Severance Tax. Numerous corporate scholarships, private endowments, and professional society scholarships provide the balance.

\*\* Courses that are not specified in the Mining Engineering Curriculum do not count toward the 69 hour total.

## **GUIDELINES AND POLICIES FOR KMES PROGRAM ADMINISTRATION**

1. Scholarships and grants-in-aid are non-repayable.
2. Scholarships and grants-in-aid are awarded for a maximum of nine (9) semesters
3. Scholarships and grant-in-aid awards are made on a semester-by-semester basis. Continued support is contingent upon academic performance.
4. A student will not be supported for more than four (4) semesters while attending UK's community colleges (see D).
5. No financial aid will be granted under the KMES program to any student not in good standing within the College of Engineering.
6. Entering freshmen or transfer students are responsible for meeting all admissions requirements and for arranging his/her own student housing. (See the current University of Kentucky Bulletin for information concerning academic requirements, fees, deadlines, student services, activities, curricula, degree requirements, academic calendar, and living accommodations.)
7. Students receiving financial aid from the Department will be asked for permission to disclose personal data (address, phone number, and academic standing) to financial aid sponsors (agencies, coal companies, societies, and/or private individuals). This is often necessary for reporting requirements imposed by sponsors but can also be helpful in providing summer or co-op (cooperative education) jobs during the student's academic career and in assisting the student in finding employment upon graduation.
8. The KMES Scholarship Committee will evaluate the student's academic performance each semester to make a determination of the level of support for which the student qualifies (see C).
9. Students are strongly encouraged to obtain summer and/or off-semester (cooperative education) work in the mining industry, but such work experience is not a requirement for financial aid.
10. All questions regarding Departmental financial aid should be addressed to: Director, Kentucky Mining Engineering Scholarship Program, 230 Mining & Mineral Resources Building, Lexington, KY 40506-0107.
11. The total amount of financial aid which a student may receive per semester is established and monitored by the UK Financial Aid Office.
12. Students are encouraged to become members of the UK Mining Engineering Foundation upon graduation. Current membership is \$25.00 per year for recent graduates.
13. Scholarship students must join and maintain student membership in the Society for Mining, Metallurgy and Exploration (SME). Current cost is \$21.00 per year.
14. Scholarship students are required to interview for summer jobs (or, in the case of seniors, permanent jobs) in the mining industry.
15. The University offers, at no charge to full time students, a program to improve organizational and study skills, consisting of a number of short courses. All Mining Engineering students are encouraged to participate in this program. We require freshman and sophomore students whose scholarship support levels drop from a higher level to the grant-in-aid level to participate in this program.
16. Adequate progress towards completion of degree requirements in Mining Engineering is required for continued receipt of a scholarship.

SECTION V:

NORWOOD STUDENT CHAPTER OF SME

## SECTION V. NORWOOD STUDENT CHAPTER OF SME

The Society for Mining, Metallurgy, and Exploration, Inc. (SME) is a national professional society with the objectives of fostering standards of professionalism, promoting technologic information exchange, providing opportunities for comradeship and recognizing professional service and accomplishment. In order to insure the future of mining engineering as a professional discipline, SME sponsors numerous student chapters at colleges and universities that offer mining engineering, mineral processing, or geology in their curricula.

The Norwood Student Chapter of SME at the University of Kentucky is named for Charles J. Norwood, the first head of the State's mine safety agency who later went on to become the head of the College of Mining at UK. Mr. Norwood was Inspector of Mines from 1884 to 1893, Chief Inspector of Mines from 1893 to 1896, and, again, from 1902 to 1919. All mining engineering students are invited and encouraged to be part of this organization.

The student organization meets regularly for technical presentations by industry personnel and informal sessions geared toward planning and information exchange. Several field trips are scheduled each year. These include trips to surface and underground mines in Kentucky and neighboring states and attendance at regional SME meetings. Each year a few students are selected to represent the student chapter at the SME annual meeting. There are also numerous social events such as picnics and an annual mining banquet that provide opportunities for student and faculty to know each other better.

Students may apply on-line at <http://www.smenet.org/join/>.

The web site for the Norwood Student Chapter of SME is [www.ukсме.org](http://www.ukсме.org).