

# MINING ENGINEERING (MIN ENG)

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## **MIN ENG 1912 Principles Of Mining Engineering** (LAB 1.0 and LEC 1.0)

Principles and definitions related to mining engineering including one or more field trips to familiarize the student with current mining practices.

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## **MIN ENG 2002 Cooperative Engineer Training** (IND 0.0-6.0)

On-the-job experience gained through cooperative education with industry, with credit arranged through departmental cooperative advisor. Grade received depends on quality of reports submitted and work supervisor's evaluation.

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## **MIN ENG 2412 Principles Of Mineral Processing** (LAB 1.0 and LEC 2.0)

Introduction to the principles of mineral processing including mineral resources; particle comminution, classification, separation and dewatering; flowsheet and equipment design.

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## **MIN ENG 2914 Surface Mine Design** (LAB 2.0 and LEC 1.0)

Surface mining methods. Conventional methods for ore reserves estimation. Geomechanics, geometrics and computer-aided mine design, haul roads and waste dump design and layouts optimization. Materials scheduling and sequencing using a commercially available mine design software. Prerequisite: Min Eng 1912.

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## **MIN ENG 2924 Underground Mine Design** (LAB 2.0 and LEC 1.0)

Underground mining methods. Parametric statistics and introductory geostatistics. Geomechanics, geometrics and computer-aided mine design. Empirical and numerical methods for mine openings, pillar and roof span design; caving and ore drawing mechanics. Materials scheduling and sequencing using commercially available software. Prerequisite: Min Eng 1912 and Min Eng 2914.

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## **MIN ENG 2925 Surveying For Mineral Engineers** (LAB 2.0)

Principles of surface and underground survey practice utilizing total station, engineer's level and GPS. Traversing and details, note taking and computations, balancing surveys and error analysis, staking-out new points, and map construction with AutoCAD. Prerequisite: Preceded or accompanied by Min Eng 1912.

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## **MIN ENG 3000 Special Problems** (IND 0.0-6.0)

Problems or readings on specific subjects or projects in the department. Consent of instructor required.

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## **MIN ENG 3001 Special Topics** (IND 0.0-6.0)

This course is designed to give the department an opportunity to test a new course. Variable title.

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## **MIN ENG 3002 Mine Rescue** (LAB 1.0 and LEC 2.0)

Utilization of the principles of mine safety concerning mine gases, ventilation, explosives, fires, and first aid in the organization of mine rescue personnel and techniques. Training in the use of current mine rescue equipment, recognition and control of common recovery hazards, handling of survivors. Prerequisite: Min Eng 2126.

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## **MIN ENG 3512 Mining Industry Economics** (LEC 3.0)

Importance of the mineral industry to national economy, uses, distribution, and trade of economic minerals, time value of money, mineral taxation, economic evaluation utilizing depreciation, depletion, and discounted cashflow concepts, social and economical significance of mineral resources. Prerequisite: Econ 1100 or 1200. (Co-listed with Econ 3512).

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## **MIN ENG 3912 Materials Handling In Mines** (LEC 2.0)

Mining applications of material transport and handling. Truck haulage and haulroads. Conveyors: belt, armored, and others; feeders; bins and bunkers; material stockpiling and homogenization; rail transport; water transport; slurry transport; mine hoists and hoisting. Prerequisite: Min Eng 1912.

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## **MIN ENG 3913 Mineral Identification and Exploration** (LAB 1.0 and LEC 2.0)

Characterization of mineral deposits. Ore body definition. Mineral Exploration techniques. Sample methods, errors and mitigation. Rock Identification and application of Geological Sciences. Hands-on lab to understand geologic concepts. Prerequisites: Either both Chem 1310 and Chem 1319 or Chem 1351.

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## **MIN ENG 4000 Special Problems** (IND 0.0-6.0)

Problems or readings on specific subjects or projects in the department. Consent of instructor required.

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## **MIN ENG 4001 Special Topics** (LAB 0.0 and LEC 0.0)

This course is designed to give the department an opportunity to test a new course. Variable title.

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## **MIN ENG 4096 Computer Aided Mine Design** (LAB 3.0)

Mine planning and design using commercial software. Orebody description. Surface mining: geometric design, pit limits, and production planning. Underground mining: development planning, opening and support design, ventilation and production planning. Group projects with real-world mining data. Preparation for capstone design project. Prerequisites: Min Eng 5522, Min Eng 5932, and Min Eng 5933.

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**MIN ENG 4097 Capstone Design Project** (LAB 2.0 and LEC 1.0)

Capstone project with written and oral presentations. Includes mine design and optimization, production plan, equipment and flowsheet design based on geology, resources/reserves, geotechnics, hydrology and hydro-geology. Project also incorporates markets, environmental and permitting, mine-mill organization, support facilities, economic and risk analyses. Prerequisite: Min Eng 4096.

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**MIN ENG 4099 Undergraduate Research** (IND 0.0-6.0)

Designed for the undergraduate student who wishes to engage in research. Not for graduate credit. Not more than six credit hours allowed for graduation credit. Subject and credit to be arranged with the instructor.

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**MIN ENG 4122 Advanced Mine Health and Safety** (LEC 3.0)

A detailed study of health and safety principles, practices, analyses, regulations, risks and hazards recognition, mitigation and control, and disaster prevention in the mining industry. Prerequisite: Min Eng 2126.

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**MIN ENG 4512 Mine Management** (LEC 3.0)

Theory and practice of mine management, including basic managerial functions, management theories, communication skills, motivation, leadership, organization, maintenance management, managerial decision making, cost control, labor relations, government relations, ethics and risks management with emphasis in presentation skills. Prerequisite: Completion of 50 credits toward Mining Engineering degree. (Co-listed ECON 4512).

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**MIN ENG 4523 Environmental And Natural Resource Economics** (LEC 3.0)

Optimum use of replenishable and non-replenishable resources, public goods and common resources, externalities, private vs. public costs, and quality of the environment; emphasis on public policy related to environmental and natural resource economics. Prerequisite: Econ 1100. (Co-listed with Econ 4440).

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**MIN ENG 4524 Energy Economics** (LEC 3.0)

For students interested in both economic and engineering issues of energy policy. Provides an assessment of economics and technology issues related to traditional and renewable energy resources. Presented in a framework that allows for analysis of the economic trade-offs between energy sources and the technologies associated with their use and extraction. Prerequisite: Econ 1100 or Econ 1200. (Co-listed with Econ 4540).

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**MIN ENG 4824 Soils and Overburden Materials for Mining Engineering** (LEC 2.0)

Physical and mechanical properties of soils and overburden materials. Soils and overburden characterization for reclamation and mine closure and overburden blasting. Soil failure modes and slope stability for surface mine layouts, waste dumps, tailings and earth dams, and foundations for heavy mining machinery. Prerequisites: Civ Eng 2210.

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**MIN ENG 5000 Special Problems** (IND 0.0-6.0)

Problems or readings on specific subjects or projects in the department. Consent of the instructor required.

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**MIN ENG 5001 Special Topics** (LEC 0.0-6.0)

This course is designed to give the department an opportunity to test a new course. Variable title.

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**MIN ENG 5113 Mine Atmosphere Control** (LAB 1.0 and LEC 2.0)

Fundamentals of mine ventilation, including the principles of airflow, control of gases, dust, and temperature, methane drainage, mine fans, network theory, computer network simulation, and economics of airflow, with emphasis on analysis, systems design and practical application. Prerequisite: Mech Eng 2527 and Civ Eng 3330; or Nuc Eng 3221.

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**MIN ENG 5212 Aggregates and Quarrying** (LEC 3.0)

Advanced coverage of topics on the stone and aggregate industry, including surface and underground operations, plant equipment, economics, marketing, transportation, and environmental topics. The course will include at least one field trip and a design project. Prerequisite: Min Eng 3912; Preceded or accompanied by Civ Eng 3116.

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**MIN ENG 5322 Coal Mining Methods** (LEC 3.0)

An in-depth study of all aspects of coal mining, including an overview of the coal industry, reserves and geology, planning and development of coal mines, surface and underground mechanized methods of face preparation, equipment, coal extraction, handling and preparation as practiced in the United States. Prerequisites: Min Eng 5912.

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**MIN ENG 5412 Aggregates Materials Sizing and Characterization** (LAB 1.0 and LEC 2.0)

Geological formation of aggregates; aggregate properties and their measurements; aggregates for specific end-user applications; specifications and standards; processing (crushing, screening, classification, and washing); plant design and flow sheet analysis; quality control and assurance. Field trip to a nearby quarry required. Prerequisite: Min Eng 2412.

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**MIN ENG 5413 Material Processing by High Pressure Water Jet** (LEC 3.0)

Methods of generating high pressure water jets; standard equipment, existing techniques and basic calculations. Applications of water jets to materials cutting and mineral processing. Safety rules. The course will be supported by laboratory demonstrations. (Co-listed with Mech Eng 5606).

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**MIN ENG 5422 Coal Preparation** (LAB 1.0 and LEC 2.0)

Coal properties, sampling, testing, breaking, sizing, cleaning and dewatering. Disposal of refuse. Prerequisite: Min Eng 2412.

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**MIN ENG 5423 Flotation and Hydrometallurgy** (LAB 1.0 and LEC 2.0)  
 Forth flotation including mineral surfaces, double layer theory, zeta potential, hydrophobicity, adsorption, collectors, frothers, modulation, kinetics, and sulphide and acid flotation systems. Hydrometallurgy including leaching, ion exchange and liquid/liquid extraction.  
 Prerequisites: Min Eng 2412.

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**MIN ENG 5424 Mineral Processing II Mechanics And Design** (LAB 1.0 and LEC 2.0)  
 Mineral particle mechanics of comminution, sizing, classification, concentration, filtering and thickening. Mill and equipment selection and design including flowsheet, development and plant assessment.  
 Prerequisites: Min Eng 2412. (Co-listed with Met Eng 5270).

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**MIN ENG 5522 Ore Reserve Analysis and Geostatistics** (LAB 1.0 and LEC 2.0)  
 Principles of geostatistics, theory of spatially correlated random variables, variance and co-variances and their application on the evaluation of mineral resources, ore reserve estimation, strategic exploration, and production planning. Real case studies from mining industry will be presented. Prerequisites: Stat 3113 or Stat 3115.

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**MIN ENG 5612 Principles of Explosives Engineering** (LAB 1.0 and LEC 2.0)  
 Theory and application of explosives in the mining industry; explosives, initiating systems, characteristics of explosive reactions and rock breakage, fundamentals of blast design, drilling and blasting, regulatory and safety considerations. Prerequisites: Min Eng 1912; successful background check. (Co-listed with Exp Eng 5612).

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**MIN ENG 5742 Environmental Aspects of Mining** (LEC 3.0)  
 Permitting: the legal environment of reclamation and environmental impact assessment; post-mining land-use selection and mine planning for optimum reclamation of all mines: metal, nonmetal, and coal; unit operations of reclamation: drainage, backfill, soil replacement, revegetation, maintenance, etc. Prerequisites: Preceded or accompanied by Min Eng 5933 or Geo Eng 5441 or Env Eng 5619. (Co-listed with Geo Eng 5276).

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**MIN ENG 5823 Rock Mechanics** (LAB 1.0 and LEC 2.0)  
 Applications of the fundamental principles of mechanics to engineering problems of equilibrium, strength and stiffness of rock materials. Review of in-situ stresses, laboratory and field instrumentation, rock and rockmass properties. Ground Control; pillar design, roof span design, rock reinforcement, surface subsidence, slope stability, and violent failure.  
 Prerequisites: Civ Eng 2210 and Geology 3310. Field trip required.

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**MIN ENG 5912 Mine Power and Drainage** (LAB 1.0 and LEC 2.0)  
 Engineering principles of mine power distribution and application and mine dewatering. Basics of electrical circuits, AC/DC power, transformers, electric meters, power distribution, and power management. Hydraulic power systems. Compressed air in mines. Mine dewatering. Controlling water inflow. Dewatering wells. Water pumping and pumping systems.  
 Prerequisite: Physics 2135 and one of the following Civ Eng 3330 or Nuc Eng 3221.

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**MIN ENG 5913 Advanced Computer Aided Mine Design** (LAB 1.0 and LEC 2.0)  
 Project-based mine planning and design course. Engineering design process applied to computer-aided mine planning and design. Mine layouts, production planning, and materials scheduling optimization.  
 Prerequisite: Graduate standing.

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**MIN ENG 5922 Tunneling & Underground Construction Techniques** (LAB 1.0 and LEC 2.0)  
 Mechanical and conventional excavation techniques in underground tunneling and construction. Topics include tunneling layouts design, equipment and performance modeling, ground control systems including support, drainage, and structural integrity. Construction specifications, advance rate and contractual and cost estimation. Prerequisite: Consent of instructor. (Co-listed with Exp Eng 5922).

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**MIN ENG 5932 Underground Mining Methods** (LEC 3.0)  
 Principles of planning, constructing, and operating economically viable underground mines. Cost effective mining methods: room-and-pillar, sublevel open stoping, VCR, shrinkage, sublevel caving, cut-and-fill, block caving, longwall. Selection of equipment for underground mining operations. Optimization of mine performance. Field trip Required.  
 Prerequisite: Preceded or accompanied by Min Eng 1912.

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**MIN ENG 5933 Surface Mining Methods** (LEC 3.0)  
 Principles of planning, constructing, and operating economically viable surface mines. Cost effective mining methods: placer mining, strip mining, open pit mining, quarrying. Selection of equipment for surface mining operations. Optimization of mine performance. Field trip required.  
 Prerequisites: Min Eng 3912.

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**MIN ENG 6000 Special Problems** (IND 0.0-6.0)  
 Problems or readings on specific subjects or projects in the department. Consent of instructor required.

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**MIN ENG 6001 Special Topics** (LAB 1.0 and LEC 2.0)  
 This course is designed to give the department an opportunity to test a new course. Variable title.

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**MIN ENG 6010 Seminar** (RSD 1.0)  
 Discussion of current topics.

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**MIN ENG 6040 Oral Examination** (IND 0.0)

After completion of all other program requirements, oral examinations for on-campus M.S./Ph.D. students may be processed during intersession. Off-campus M.S. students must be enrolled in oral examination and must have paid an oral examination fee at the time of the defense/comprehensive examination (oral/ written). All other students must enroll for credit commensurate with uses made of facilities and/or faculties. In no case shall this be for less than three (3) semester hours for resident students.

**MIN ENG 6050 Continuous Registration** (IND 1.0)

Doctoral candidates who have completed all requirements for the degree except the dissertation, and are away from the campus must continue to enroll for at least one hour of credit each registration period until the degree is completed. Failure to do so may invalidate the candidacy. Billing will be automatic as will registration upon payment.

**MIN ENG 6080 Graduate Project** (IND 3.0)

Advanced engineering design, experimentation, evaluation and assessment leading to the preparation of a project report. For practicing professionals, this project could be based on an actual industry problem. Prerequisites: Graduate Standing.

**MIN ENG 6085 Internship** (IND 0.0-15)

Students working toward a doctor of engineering degree will select, with the advice of their committees, appropriate problems for preparation of a dissertation. The problem selected and internship plan must conform to the purpose of providing a high level engineering experience consistent with the intent of the doctor of engineering degree.

**MIN ENG 6099 Research** (IND 0.0-15)

Investigations of an advanced nature leading to the preparation of a thesis or dissertation. Consent of instructor required.

**MIN ENG 6133 Mine Atmospheric Control II** (LEC 3.0)

Climatic measurements and temperature precalculations, emergency plans for fan failures and mine fires, mine air contaminants, mine noises, mine dust, refrigeration and cooling plant layout, radiation control. Prerequisite: Min Eng 5113.

**MIN ENG 6522 Mining Property Feasibility Studies And Evaluation Procedure** (LAB 1.0 and LEC 2.0)

A systematic phased approach is presented, designed to increase the level of confidence and accuracy of estimates, moving from exploration through to a "bankable" study. Liability, ethics, resource/reserves, political/social/investment risk, economic parameters, and due diligence are discussed. Prerequisite: Min Eng 3512 or Geology 3511 or Min Eng 4742 or Geophys 3251.

**MIN ENG 6842 Advanced Rock Mechanics** (LEC 3.0)

Advanced topics in static and dynamic rock mechanics; elasticity theory, failure theories and fracture mechanics applied to rock; stress wave propagation and dynamic elastic constants; rock mass classification methods for support design; pillar design in coal and metal mines; introduction to numerical models. Prerequisite: Min Eng 5823 or Civ Eng 3715.

**MIN ENG 6912 Advanced Simulation of Mining Systems** (LEC 3.0)

Stochastic, discrete and discrete-continuous, Monte Carlo simulation. Model formulation using general purpose discrete-event simulation software. Model verification and validation. Simulation experimentation. Prerequisites: Stat 5643 or graduate standing.

**MIN ENG 6922 Optimization Applications In Mining I** (LEC 3.0)

Mining applications of deterministic optimization techniques are covered, including linear, integer, mixed-integer, dynamic, unconstrained and constrained nonlinear, and heuristic programming. Prerequisite: Graduate standing or consent.

**MIN ENG 6932 Advanced Mining Systems** (LEC 3.0)

Principles of design for the development and production of hard rock mineral deposits that require integrated surface and underground mining methods. Cost considerations leading to optimization. Terminal feasibility report required. Prerequisites: Min Eng 4932 and Min Eng 4933.

**MIN ENG 6935 Underground Mine Design** (LEC 3.0)

This course will focus on the determinants of underground mine design, geomechanical mine design for underground mining; mine optimization; mine environmental systems; and underground mine design and optimization. Prerequisite: Min Eng 4932 or equivalent.

**MIN ENG 6936 Surface Mine Design** (LEC 3.0)

This course will focus on the determinants of surface mine design, geomechanical and geometrical mine design for open pit and strip mining; mine layouts optimization; mine environmental systems; and research directions in surface mine design and optimization. Prerequisites: Min Eng 5933 or graduate standing.

**MIN ENG 6992 Research Methods** (LEC 3.0)

Foundations, dimensions, and methods for designing and investigating research problems. Focus on fundamentals and applied research, research methods, literature review, experimental design and experimentation, dissertation composition, concepts of originality and intellectual property. Prerequisites: PhD students only. (Co-listed with Exp Eng 6292).