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Mining Engineering

***Enrollments in Mining Engineering have been suspended indefinitely.**

Master of Science in Mining Engineering

Graduate work leading to the Master of Science degree in mining engineering is offered by the College of Engineering. The program is designed to provide advanced study in areas such as rock mechanics and ground control, mine design, mineral and coal processing, surface and underground mining systems performance optimization, innovative mining systems, surface mine reclamation, in-situ mining, mine environment and ventilation, coalbed methane reservoir engineering, carbon dioxide sequestration, dust control, and coal combustion byproduct utilization and management.

Admission

Students seeking admission to the graduate program in mining engineering must meet the admission standards set by the Graduate School and have a bachelor's degree in engineering or its equivalent. A student whose undergraduate training is deficient may be required to take coursework without graduate credit.

This program requires a nonrefundable \$65 application fee that must be submitted with the application for Admissions to Graduate Study in Mining Engineering. Applicants must pay this fee by credit card.

Requirements

A graduate student in mining engineering is required to develop a program of study with a graduate adviser and a graduate committee. Each student majoring in mining engineering may, with the approval of the graduate committee, also take courses in other branches of engineering or in areas of science and business. For a student who wishes to complete the requirements of the master's degree with a thesis, a minimum of thirty semester hours of acceptable graduate credit is required. Of this total, eighteen semester hours must be earned in the mining engineering department. Each candidate is also required to pass a comprehensive oral examination covering all of the student's graduate work including thesis. A minimum of 15 hours must be earned in courses numbered 500 or above.

If a student prefers the non-thesis option, a minimum of 36 semester hours of acceptable graduate credit is required. The student is expected to take at least 21 semester hours within mining engineering including no more than 3 semester hours of the appropriate 592 course to be devoted to the preparation of a research paper. In addition, each candidate is required to pass a written comprehensive examination and an oral examination on the research paper.

If a student with a mining engineering background pursues a master's degree with double major, he or she will be required to take a minimum of 18 credits with thesis option and 22 credits with non-thesis option in mining engineering and 60 percent of the total credit requirements of the other department. For a student without a background in the related fields such as minerals engineering, geological engineering etc., the minimum credit requirement in the mining department will be 24 credits with thesis option and 28 credits with non-thesis option. Additional deficiency courses will be prescribed for students with a background in non-related fields.

Each student will select a minimum of three graduate faculty members to serve as a graduate committee, subject to the approval of the chair of the Department of MMRE. At least two of the committee members must be from the mining engineering department. The committee will:

1. approve the student's program of study,
2. approve the student's research topic,
3. approve the completed research paper or thesis, and
4. administer and approve the written, or oral, comprehensive examination.

Teaching or research assistantships and fellowships are available for qualified applicants. Assistantship and fellowship support is limited to two years in line with the Department's expectations of student's time to graduate. An extension of one semester is approved only under exceptional circumstances (eg: equipment failures). Additional information about the program, courses, assistantships, and fellowships may be obtained from the College of Engineering or the Department of Mining and Mineral Resources Engineering.

Mining Engineering Courses

ME400 - Engr Thermodynamics II 400-3 Engineering Thermodynamics II. Combined first and second law analysis: Exergy analysis; Analysis of power and refrigeration cycles. Detailed treatment of gas and vapor cycles including gas and steam cycles; Thermodynamics of combustion and reaction of mixtures; Introduction to thermodynamic property relations, chemical and phase equilibrium. Prerequisite: ME 300.

ME401 - Thermal Measurements Lab 401-1 Thermal Measurements Laboratory. Study of basic measurements used in the thermal sciences. Calibration techniques for temperature and pressure sensors. Thermal measurements under transient and steady-state conditions. Applications include conduction, convection and radiation experiments. Uncertainty analysis. The handling and reduction of data. Prerequisite: ME 302.

ME405 - Transportation Power Systems 405-3 Transportation Power Systems. Operation and performance characteristics of Otto, Diesel, Atkinson cycles. Methods of engine testing, types of fuels and their combustion, exhaust gas analysis. Types, selection, and analysis of jet engines. Analysis of fuel cell types, their performance and limitations. Operation of electric motors, capacitors, battery packs and their charging. Prerequisite: concurrent enrollment in or completion of ME 400, with a minimum grade of C or consent of instructor.

ME406 - Thermal Systems Design 406-3 Thermal Systems Design. Applications of the principles of engineering analysis to the design of thermal systems. Coordination of such systems as heat exchangers, air conditioners, cogeneration cooling towers, and furnaces. Emphasis is placed on application of basic principles of heat transfer and fluid mechanics. Prerequisite: ME 302.

ME408 - Energy Conversion Systems 408-3 Energy Conversion Systems. Principles of advanced energy conversion systems; nuclear power plants, combined cycles, magnetohydrodynamics, cogeneration (electricity and process steam), and heat pumps. Constraints on design and use of energy conversion systems; energy resources, environmental effects, and economics. Prerequisite: ME 400.

ME410 - Appl Chem Thermo & Kinetics 410-3 Applied Chemical Thermodynamics and Kinetics. Designed for students interested in chemical and environmental processes and materials science. Topics covered include application of the Second and Third Laws of Thermodynamics, solution theory, phase equilibria, sources and uses of thermodynamic data, classical reaction rate theory, kinetic mechanisms and the determination of rate-determining steps in chemical reactions. Prerequisite: CHEM 200, 201, ME 300 or consent of instructor.

ME415 - Engineering Acoustics 415-3 Engineering Acoustics. Principles of engineering acoustics and their applications to passive and active noise control techniques. Laboratory experience demonstrates techniques for control and reduction of noise. Prerequisite: ME 336.

ME416 - Air Pollution Control 416-3 Air Pollution Control. An overview of problems in air pollution likely to influence the Mechanical Engineer. Engineering control theory, procedure and equipment related to

control of particulate, gaseous, and toxic air emissions. Restricted to senior standing and College of Engineering or consent of instructor.

ME421 - Pneumatic Hydraulic Engr 421-3 Pneumatic Hydraulic Engineering. Design principles of fluid power engineering. The behavior of fluids in a system. Analysis and design of hydraulic and pneumatics machinery and systems using fluid as a medium for transmission of power and control of motion. Analysis of steady state and dynamic behavior. Critical operations and analysis.

ME422 - Appl Fluid Mechanics for ME 422-3 Applied Fluid Mechanics for Mechanical Engineers. Applications of fluid mechanics in internal and external flows. The mathematical basis for inviscid and viscous flows calculations is developed with application to pipe and duct flows; external flow about bodies; drag determination; turbomachinery; and reaction propulsion systems. Semester design project of a fluid mechanical system. Prerequisite: ME 300 and MATH 305; ENGR 370A or 370B concurrently.

ME423 - Compressible Flows 423-3 Compressible Flows. Foundation of high speed fluid mechanics and thermodynamics. One-dimensional flow, isentropic flow, shock waves and nozzle and diffuser flows. Flow in ducts with friction and heat transfer. Prandtl-Meyer flow. Compressibility effects in reaction propulsion systems. Semester design project. Prerequisite: ME 300; ENGR 370A or 370B concurrently.

ME435 - Des:Mass Transfer Processes 435-3 Design of Mass Transfer Processes. Design principles of mass transfer processes. The rate mechanism of molecular, convective and interphase mass diffusion. The design of selected industrial mass transport process operations such as absorption, humidification, water-cooling, drying and distillation. Prerequisite: ME 302.

ME440 - Design HVAC & Build Energy Sys 440-3 Design of HVAC and Building Energy Systems. Building energy design and simulation; HVAC systems, heating and cooling load analysis; Air conditioning processes; Principles of human thermal comfort. Prerequisite: ME 302. Restricted to graduate standing or consent of the instructor.

ME446 - Energy Management 446-3 Energy Management. Fundamentals and various levels of analysis for energy management of commercial buildings and industrial processes and buildings. Use of energy management systems and economic evaluations are required in course projects. Prerequisite: ME 302.

ME449 - Mechanics of Adv Materials 449-3 Mechanics of Advanced Materials. Mechanical behavior of composite materials, cellular materials, functionally graded materials. Constitutive equations for the linear and nonlinear ranges, failure theories, fracture mechanics. Application to the design of composite and sandwich structures, pressure vessels, shafts, armor under static loading, impact and blast loading. Prerequisite: ENGR 261; ENGR 350A or 350B concurrently.

ME451 - Advanced Dynamics 451-3 Advanced Dynamics. Three-dimensional kinematics and dynamics of particles and rigid bodies; Coordinates and reference frames; Rotations of rigid bodies; Euler angles; Newtonian mechanics; Work and energy; Generalized coordinates and degrees of freedom; Analytical mechanics with a focus on Lagrange's equations; Hamilton's principle for continuous elastic systems. Prerequisites: MATH 305 and ME 309 with a grade of C or better or graduate standing.

ME463 - Introduction to Ceramics 463-3 Introduction to Ceramics. Structure and physical properties, mechanical properties, processing and design of ceramics. Prerequisite: ME 312 or equivalent.

ME465 - Intro to Nanotechnology 465-3 Introduction to Nanotechnology. Survey of the rapidly developing fields of nanometer science and engineering. Impact on society; principles of self-assembly; production and properties of nano-materials; cell mechanism as a model for assemblers; nano-tools; and nano-systems are explored. Prerequisite: CHEM 210.

ME468 - Friction Science & Apps 468-3 Friction Science and Applications. Study of systems and materials used for friction applications with a focus on aerospace and ground transportation vehicles. Course covers theories and experimental methods regarding friction and wear, contact mechanics, friction materials, vibration and noise, thermal transport and thermo-elastic phenomena. The course approach uses a materials emphasis. Prerequisite: ME 312. Restricted to senior standing or consent of instructor.

ME470 - Mech System Vibrations 470-3 Mechanical System Vibrations. Linear vibration of mechanical systems; System modeling; Free and forced response of single degree of freedom systems; Lagrange's

equations; Multi-degree of freedom systems; Modal analysis for response calculations; Vibration of continuous systems. Prerequisite: ENGR 261, ENGR 351, MATH 305.

ME472 - Materials Selection for Design 472-3 Materials Selection for Design. Interaction of material design process with material selection criteria. Comparison of materials properties, processes and fabrication. Project work includes design models, materials selection rationale, oral presentation of projects, construction of mock-up models, and theoretical design problems in the area of the student's specialization, including materials selection considerations for biomaterials/biomedical applications. Prerequisites: ME 312, ENGR 261; ME 222 or ENGR 222 or ENGR 296.

ME475 - Machine Design I 475-3 Machine Design I. Design of machines using bearings, belts, clutches, chains and brakes. Develops application of the theory of fatigue, power transmission and lubrication to the analysis and design of machine elements. Prerequisite: ENGR 351; ENGR 350A or 350B concurrently.

ME477 - Fund Comp Aid Des & Manf 477-3 Fundamentals of Computer-Aided Design and Manufacturing. Introduction to the concepts of computer-aided design and manufacturing (CAD/CAM). Subjects include computer graphics, geometric modeling, engineering analysis with FEM, design optimization, computer numerical controls, project planning, and computer integrated manufacturing. (CIM). Students are required to use computer packages for projects. Prerequisite: ME 475 or consent of instructor.

ME478 - FEA in CAD 478-3 Finite Element Analysis in CAD. Course to cover a multitude of topics in CAD/CAE with emphasis on finite element modeling and analysis. Overview of CAD/CAM/CAE; FEA software; FEA problems including trusses, beams, frames, thermal analysis, and fluid mechanics; design optimization; rapid prototyping. Students are required to use FEA software for homework assignments and a design project. Prerequisite: ME 302. Co-requisite: ME 475.

ME480 - Computational Fluid Dynamics 480-3 Computational Fluid Dynamics. Application of computational fluid dynamics techniques to the solution of problems in engineering heat transfer and fluid flow. Discretization techniques; stability analysis. Introduction to grid generation. Prerequisite: ENGR 351, ENGR 370A (or 370B concurrently); ME 302 or consent of instructor.

ME481 - Design/Implement Vision System 481-3 Design and Implementation of Vision System. (Same as BME 481) This course provides an introduction to a vision system and instrumentation with engineering applications including optical microscopy. A vision system is an essential tool in most of the application, and optical microscopy is a powerful scientific tool to study microscale worlds. Topics covered in basic geometrical optics, Optoelectronic devices, basic electronics for illumination system, optical microscopy, actuators in the microscope, fundamentals of fluorescence microscopy, and advanced imaging techniques. Prerequisites: ENGR 296 or ME 222 or consent of instructor.

ME485 - Cell & Molecular Biomechanics 485-3 Cellular and Molecular Biomechanics. (Same as BME 485) Mechanics of living cells at the micron/nanoscale level. Molecular forces, bond dynamics, force-induced protein conformational changes. Structural basis of living cells, contractile forces, mechanics of biomembranes, nucleus, cytoskeletal filaments- actin, microtubule, intermediate filaments. Active and passive rheology, microrheological properties of cytoskeleton. Active cellular processes such as cell adhesion, cell spreading, control of cell shape, and cell migration. Discussion on experimental techniques including single-molecule approaches to understanding key cellular processes. Discussion of theoretical models that predict cellular processes and limitations. Introduction to mechanobiology. Restricted to senior or graduate standing.

ME486 - Nondestructive Eval Engr Matls 486-3 Nondestructive Evaluation of Engineering Materials. (Same as CE 486) Overview of common nondestructive evaluation (NDE) techniques, such as visual inspection, eddy current, X-ray, and ultrasonics, to measure physical characteristics of and to detect defects in engineering materials. Laboratory experiments include contact ultrasonic, magnetic particle, liquid penetrant, and infrared thermography methods of testing. Prerequisite: ME 312 with a grade of C or better.

ME493 - Materials in Energy 493-3 Materials in Energy Applications. Materials are central to every energy technology. The course will provide information on high performance materials for alternative energy technologies and developing a fundamental understanding of their structure-property-performance

relationships. It will include materials for fuel cells, lithium ion batteries, supercapacitors, photovoltaics, solar energy conversion, thermoelectrics, and hydrogen production and storage, catalysts for fuel conversion. Prerequisite: ME 312.

ME500 - Advanced Thermodynamics 500-3 Advanced Engineering Thermodynamics. This course creates computer programs to solve complex problems in thermodynamics relating to vapor power cycles, gas power cycles, refrigeration cycles, and psychrometric evaluations. The course also covers advanced thermodynamic relations involving equations of state and chemical equilibrium. Prerequisite: ME 400 or equivalent or consent of instructor.

ME501 - Transport Phenomena 501-3 Transport Phenomena. Mechanism of heat, mass and momentum transport on both molecular and continuum basis. Estimation of transport properties. Generalized transport equations in one- or three-dimensional systems. Analogy of mass, heat and momentum transfer. Macroscopic balances, simultaneous mass and heat transfer. Prerequisite: ME 302.

ME502 - Conduction Heat Transfer 502-3 Conduction Heat Transfer. Engineering considerations involving the construction of mathematical and numerical models of conduction heat transfer and the interpretation of results of analyses. Prerequisite: ME 302.

ME503 - Convective Heat Transfer 503-3 Convective Heat Transfer. Laminar and turbulent forced convection heat transfer over surfaces and inside tubes, including non-circular cross sections. Developing flows. Laminar free convection. Emphasis throughout is on the analytical approach. Prerequisite: ME 302.

ME504 - X-Ray Diff & Elect Micro 504-3 X-Ray Diffraction and Electron Microscopy. X-ray physics. Geometry of crystals. Scattering of X-ray by atoms, crystals and noncrystalline matter. Kinematical theory of diffraction. Powder method, Laue method. Electron optics. Formation and analysis of diffraction patterns. Imaging techniques. Image contrast theories. Analysis of crystal defects. Advanced analytical electron microscopes. Special approval needed from the instructor.

ME505 - Vehicle Dynamics 505-3 Vehicle Dynamics. To provide an introductory coverage of dynamics of vehicle systems. The topics include mainly automotive systems but others such as aircraft and train systems may be discussed. Students will become familiar with issues related to tire behavior, vehicle suspension design, steering, vehicle and load transfer. Prerequisite: ENGR 261.

ME507 - Combustion Phenomena 507-3 Combustion Phenomena. Basic combustion phenomena-chemical rate processes-flame temperature, burning velocity, ignition energy, quenching distance and inflamability limits-laminar and turbulent flame propagation-aerodynamics of flame-gaseous detonations-two phase combustion phenomena-fluidized bed combustion. Prerequisite: ME 300.

ME508 - Nanoscale Heat Transfer 508-3 Nano/Microscale Energy and Heat Transfer. Review of limitations of macroscopic energy transport models; Energy transport and conversion mechanisms at the micro/nano/molecular scale; Energy transfer in nanostructured energy devices; Related topics on the transport of electrons, phonons and molecules; Molecular Dynamics simulation. Restricted to graduate standing or consent of the instructor.

ME509 - Radiation Heat Transfer 509-3 Thermal Radiation Heat Transfer. Review of radiation fundamentals. Prediction of radiative properties using classical electromagnetic theory. Properties of real materials. Governing equations between blackbody and graybody surfaces. Exchange of radiation between nondiffuse, nongray surfaces. Radiation in the presence of other energy transfer modes. Approximate and computer solution techniques. Prerequisite: ME 302.

ME525 - Small Particle Phenomena 525-3 Small Particle Phenomena. Small particle formation, behavior, properties, emission, collection, analysis and sampling. Includes atomization, combustion, transport of suspension and sols, filtration, light scattering and movement patterns of mono and polydisperse particles and use of a device to measure size, size distribution and one other physical property of an aerosol. Restricted to graduate standing.

ME531 - Reaction Engineering 531-3 Reaction Engineering and Rate Processes. Chemical kinetics of homogeneous and heterogeneous reactions, kinetic theories, mechanism and mathematical modeling. Reactor design. Design of multiple reactions; temperature and pressure effects. Nonisothermal and nonadiabatic processes. Non-ideal reactors. Prerequisite: ME 435.

ME535 - CAD of Mechanical Systems I 535-3 Computer Aided Analysis of Mechanical Systems I. Computer aided kinematic and dynamic analysis of planar mechanism: topics will include formulation of kinematic and dynamic equations of motion for planar systems. Automatic generations of kinematic constraint such as revolute joint, translation joint, etc. Numerical techniques for solution of nonlinear, differential, and algebraic equations, application of these techniques to planar mechanism and robotic systems. Prerequisite: ME 309.

ME537 - Nonlinear Vibrations 537-3 Nonlinear Vibrations. Dynamic response and stability of nonlinear systems. Examples and sources of nonlinearity. Various techniques for studying dynamic behavior or nonlinear systems. Prerequisite: ME 470 or consent of instructor.

ME538 - Applied Optml Des/Cont Dyn 538-3 Applied Optimal Design and Control of Dynamic Systems. Unconstrained and Constrained Mechanical-System Optimization Problems; Variational Calculus; Continuous Optimal Control; The Maximum Principle and Hamilton-Jacobi Theory; Dynamic-Systems Optimum-Control Examples; Design Sensitivity Analysis; Numerical Methods for Dynamic-System Design and Control Problems; Application of the above techniques to Large Scale Dynamic Systems. Prerequisite: ME 470 or equivalent.

ME539 - Catalysis 539-3 Catalysis in Energy Processes. This course spans the full range from fundamentals of kinetics and heterogeneous catalysis via modern experimental and theoretical results of model studies to their equivalent large-scale energy processes. Several processes are discussed including hydrogen production, fuel cells, liquid fuel synthesis. Prerequisite: ME 410 or consent of instructor.

ME540 - Intro to Continuum Mechanics 540-3 Introduction to Continuum Mechanics. Tensor analysis applied to continuum mechanics: stress and strain and their invariance, equations of compatibility, constitutive equations - including linear stress-strain relations. Prerequisite: ENGR 350A, MATH 305. Restricted to graduate standing in engineering.

ME545 - Intelligent Control 545-3 Intelligent Control. Techniques to design and develop intelligent controllers for complex engineering systems. Specific techniques covered are fuzzy logic, expert systems, genetic algorithms, simulated annealing and any combinations of these. Prerequisite: ME 336 or consent of instructor.

ME549 - Wave Prpgtn, Impct & Explsns 549-3 Wave Propagation, Impact and Explosions. This course will deal with the dynamic response of materials and structures to dynamic events with particular emphasis on crashes, impacts and explosions. Prerequisite: ENGR 261 or consent of instructor.

ME550 - Contact Mechanics 550-3 Contact Mechanics. Course covers fundamentals of mechanics of elastic and inelastic solids in contact. Although the primary focus is on elastic contact, topics involving plastic flow, thermo-elastic effects and contact of rough surfaces are included in the content. Restricted to graduate standing.

ME551 - Advanced Vibration 551-3 Advanced Vibration. Analytical techniques for the vibration of discrete, continuous, and hybrid discrete-continuous systems; Vibration of conservative and nonconservative systems with focus on their representation in terms of linear operators; Properties of vibrating systems; Discretization methods for the analysis of continuous and nonlinear systems; Vibration and stability of gyroscopic systems. Prerequisite: ME 470 with a grade of C or better or graduate standing.

ME555 - Materials Processing 555-3 Materials Processing. Course to cover a multitude of topics in the processing of metals, ceramics and, to a lesser extent, polymers. Examples are: materials beneficiation, extraction, solidification, sintering and thin film deposition; topics for which the scientific basis for the processes is well established. Prerequisite: ME 312 and 410 or consent of instructor.

ME562 - Envir Degradation of Materials 562-3 Environmental Degradation of Materials. Course designed for majors in engineering and the physical sciences. Topics covered include general corrosion, oxidation, hydrogen embrittlement, stress corrosion cracking and fine particle erosion. Approach will draw on principles of chemistry and materials science. Prerequisite: CHEM 200 and CHEM 210, ME 312, or consent of instructor.

ME564 - Ceramic Materials Electronics 564-3 Ceramic Materials for Electronics. Ceramic materials contribute essential passive functions as components for a wide range of electronic applications related to sensors and energy converters. Ceramic material's electronic properties, electronic and ionic conduction in ceramic oxides; processing, properties and applications of ceramic materials for electronics, solid-oxide fuel cells, properties, fabrication and performance will be covered in this course. Prerequisite: ME 312, 463 or consent of instructor.

ME565 - Finite Element Analysis 565-3 Finite Element Analysis. (Same as CE 551) Finite element analysis as a stress analysis or structural analysis tool. Derivation of element stiffness matrices by various means. Application to trusses, plane stress/strain and 3-D problems. Dynamic and material nonlinearity problems. Restricted to graduate standing in engineering or consent of instructor.

ME566 - Advanced Mechanics-Materials 566-3 Advanced Mechanics of Materials. (Same as CE 557) Advanced topics in mechanics of materials including: elasticity equations; torsion of non-circular sections; generalized bending including curved beams and elastic foundations; shear centers; failure criteria including yielding, fracture and fatigue; axisymmetric problems including both thick and thin walled bodies; contact stresses; and stress concentrations. Restricted to graduate standing in engineering or consent of instructor.

ME567 - Tribology 567-3 Tribology. Analysis and design of tribological components particularly bearings. A number of modern developments in the field and advanced topics will be presented. Restricted to graduate standing or consent of instructor.

ME568 - Alt Energy & Fuel Resources 568-3 Alternative Energy and Fuel Resources. The course covers the alternatives for energy resources and the impact of the human growth on the energy usage and its environmental consequences. The course describes the fossil fuel era, renewable energy resources, and hydrogen fuel era. The fundamentals of each of these fuel types, their conversion to usable energy and the potential of each of these fuels for the future is discussed. Prerequisite: ME 300 and 400, or instructor's consent.

ME569 - Non-Destructive Evaluation 569-3 Non-Destructive Evaluation. Course to cover a multitude of topics in non-destructive evaluation (NDE) techniques with emphasis on recent advancements in the field. Introduction to the field of NDE. Overview of common NDE techniques, such as visual inspection, eddy current, X-ray and ultrasonics. Recent development and research areas in NDE.

ME577 - Bioprocess Engineering 577-3 Bioprocess Engineering. (Same as BME 577) This course introduces the Mechanical and/or the Biomedical Engineer to the applications of bioprocesses to biotechnology, bacterial cell cultivation, animal cell cultivation, plant cell cultivation and medical applications bioprocessing. Attention will be given to a short survey of the working cells and reactors for cell growth, but will be an overview in nature. Restricted to graduate student standing.

ME580 - Seminar 580-1 Seminar. Presentations of topics in the broad areas of mechanical engineering such as thermal, mechanics, materials and acoustics. Restricted to enrollment in program leading to Master of Science of Mechanical Engineering.

ME581 - Microrobotics 581-3 Microrobotics. This course provides an introduction to Microrobotics which is a newly emerging robotics field. Since the micro/nano-scale technologies have been improved dramatically, the microrobot has been highlighted for applications in healthcare, biotechnology, etc. Topics covered: the forces and its effects on microrobots at the micron scale, the fabrication methods, control/sensing methods for microrobots, microrobots actuation methods, and locomotions in low Re number regime. In addition, the course will summarize and describe the near-future challenges in Microrobotics. Restricted to graduate standing.

ME582 - Experimental Research Tools 582-1 Experimental Research Tools. Topics important to engineering graduate students engaging in research. These topics include: laboratory safety, statistical data analysis, experimental design, library research and chemical hygiene. Restricted to graduate enrollment in Engineering.

ME583 - Technical Research Reporting 583-1 Technical Research Reporting. Analysis of technical and scientific writing: journal article, thesis, research paper. Guidelines and principles for writing engineering

research literature and proposals. Term project involving thesis or research paper proposal to meet department requirements. Prerequisite: ME 582. Special approval needed from the instructor.

ME592 - Special Investigations in ENGR 592-1 to 4 Special Investigations in Engineering. Advanced topics in thermal and environmental engineering. Topics are selected by mutual agreement of the student and instructor. Four hours maximum course credit. Special approval needed from the instructor and department chair.

ME593 - Spec Topics in Mech Engr 593-3 Special Topics in Mechanical Engineering. Studies of special topics in various areas in mechanical engineering. Such topics as coal refining, energy conversion, thermal systems, mechanics, robotics, CAD/CAM, TOM and engineering materials. Special approval needed from the instructor.

ME595 - Research Paper 595-3 Research Paper. Research paper on a topic approved by a faculty advisor and committee in Mechanical Engineering. This course is restricted to graduate students in the non-thesis option. Restricted to graduate standing in Mechanical Engineering. Special approval needed from the instructor or department.

ME599 - Thesis 599-1 to 6 Thesis. Six hours maximum course credit.

ME601 - Continuing Enrollment 601-1 per semester Continuing Enrollment. For those graduate students who have not finished their degree programs and who are in the process of working on their dissertation, thesis, or research paper. The student must have completed a minimum of 24 hours of dissertation research, or the minimum thesis, or research hours before being eligible to register for this course. Concurrent enrollment in any other course is not permitted. Graded S/U or DEF only.

Mining Engineering Faculty

Chugh, Yoginder P., Professor, Emeritus, Ph.D., Pennsylvania State University, 1971; 1977. Coal combustion byproduct utilization and management, rock mechanics, ground control, coal mining dust control and production engineering in coal mines.

Harpalani, Satya, Professor, Ph.D., University of California, Berkeley, 1985; 2002. Mine ventilation, coal bed methane reservoir engineering, in situ mining, and carbon dioxide sequestration.

Mohanty, Manoj, Professor, Emeritus, Ph.D., Southern Illinois University Carbondale, 1997; 2000. Coal and mineral processing, experimental design and statistical analysis.

Paul, Bradley, Associate Professor, Emeritus, Ph.D., University of Utah, 1989; 1990. Underground mining systems and solution mining, minerals processing, hard rock and industrial minerals, geostatistics, mine environmental studies.

Sinha, Atmesh K., Professor, Emeritus, Ph.D., University of Sheffield, England, 1963; 1975

Spearing, A.J.S. (Sam), Associate Professor, Emeritus, Ph.D., Technical University of Silesia, 1993; 2007. Mine design, rock mechanics, backfill, strata control and risk assessment.

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Catalog Year Statement:

Students starting their collegiate training during the period of time covered by this catalog (see bottom of this page) are subject to the curricular requirements as specified herein. The requirements herein will extend for a seven calendar-year period from the date of entry for baccalaureate programs and three years for associate programs. Should the University change the course requirements contained herein subsequently, students are assured that necessary adjustments will be made so that no additional time is required of them.