

## Master of Business Administration—MBA

**806 Business Ethics and the Legal Environment**  
Fall, Spring. 2(2-0) R: Open only to MBA students.

Framework for identifying, analyzing, and resolving ethical dilemmas in business. Examination of key legal topics in business using critical thinking analysis.

**808 Leadership and Teamwork**  
Fall, Spring. 1(1-0) R: Open only to MBA students.

Understanding team management and leadership through experiential and skill-based learning. Effective communication, including the use of electronic communication technologies for team development and maintenance. Active practice of teamwork, communication, and leadership skills.

**812 Managerial Accounting Strategies**  
Fall, Spring. 2(2-0) R: Open only to MBA students.

Performance measurement and incentive system design. Organization structure, budgeting, and transfer pricing. Target costing. Relevant costs and management decision models. Activity-based costing. Aligning management accounting and firm strategy. Accounting for quality. International perspective on management accounting issues.

**814 Applied Economics**  
Fall, Spring. 2(2-0) R: Open only to MBA students.

The economic view of the firm. Modeling market mechanics in supply and demand, marginal concepts, elasticity, market characteristics, pricing with market power, and strategic behavior. Applications to business problems and situations. Principal-agent relationships and wealth maximization. Offered half of semester.

**816 Business Presentations**  
Fall, Spring. 1(1-1) R: Open only to MBA students.

Development of effective interpersonal communications skills. Emphasis is on oral communications in business settings.

**820 Marketing Management**  
Spring, Summer. 3(3-0) R: Open only to MBA students.

Concepts, methods, and applications of decision modeling to address marketing issues such as market segmentation and positioning, new product development, and advertising response and budgeting. Advanced techniques to model marketing decision problems facing marketing managers to ensure optimum outcomes for the firm and its managers.

**821 Supply Chain Management**  
Spring, Summer. 3(3-0) R: Open only to MBA students.

Integrative approach to product design, development, and delivery. Flow of products from concept development through delivery to the final user, including product and process development, managing information and product flows, total quality management, and resource and capacity management.

**822 Financial Management**  
Spring, Summer. 3(3-0) R: Open only to MBA students.

Investment decisions by firms. Value creation, risk and return, pricing models, and financial markets. Financing alternatives, market efficiency, capital budgeting, and leverage and risk relationships. Optimizing firm value. Agency problems and effects on investment and financing decisions. Offered half of semester.

**823 Information Technology Management**  
Spring, Summer. 2(2-0) R: Open only to MBA students.

Role of information technology in operations, decision making, and learning in organizations. Competitive and economic benefits from managing information technology resources. How information technology can achieve competitive advantage, efficient operations, and improved decision quality.

**824 Managing the Workforce**  
Spring, Summer. 2(2-0) R: Open only to MBA students.

Role of workforce management in fulfilling the goals and mission of the organization. Theories and applications of management principles to acquiring, motivating, and rewarding employees and structuring their work. Domestic and international issues in the workplace.

**826 International, Comparative, and Cross-Cultural Business**  
Spring, Summer. 2(2-0) R: Open only to MBA students.

International businesses' approaches to global markets, economic trade issues, methods of entry, and organizational alternatives. Cross-cultural differences and their impacts on business practices. Trade agreements, strategic alliances, negotiations, and cultural consequences. Offered half of semester.

**840 Applied Business Experience**  
Fall, Summer. 3(0-9) R: Open only to MBA students.

Student teams work on projects in organizations identified by a company sponsor and approved by a faculty adviser.

**841 Studies in the Global Marketplace**  
Summer. 3(1-4) R: Open only to MBA students.

Commercial, economic, cultural, and political aspects of global environments. Exposure to leading executives and government representatives in world markets. Comparative framework for competitive strategy in a multi-country context. International field trip required.

**850 Integrative Case Experience and Future Global Strategies**  
Fall, Spring. 2(2-0) R: Open only to MBA students.

Future trends in management. Strategic positioning of organizations for success. An integrative case experience focusing on a specific corporate situation. Use of library and computer network sources. Case presentation to faculty and business managers.

**889 Hospitality Industry Field Study**  
Fall, Spring, Summer. 3 to 6 credits. A student may earn a maximum of 6 credits in all enrollments for this course. Interdepartmental with Hospitality Business. Administered by School of Hospitality Business. P:NM: 12 credits graduate course work R: Open only to graduate students in the College of Business.

Research on a current issue, problem or opportunity into a segment of the hospitality industry. Industry relationships and networking. Faculty supervision in a field setting.

**891 Special Topics in Business Management**  
Fall, Spring, Summer. 1 to 3 credits. A student may earn a maximum of 6 credits in all enrollments for this course. R: Open only to MBA students.

Current and emerging issues in management. New and changing developments affecting managers.

**893 MBA Internship Experience**  
Fall, Spring, Summer. 1 credit. A student may earn a maximum of 2 credits in all enrollments for this course. P:NM: Completion of at least one semester in the MBA program. R: Open to MBA students except students in the Advanced Management Program or Program in Integrative Management.

Internship in business organizations; application of business knowledge and management techniques in a work environment.

## MATERIALS SCIENCE AND MECHANICS MSM

### Department of Materials Science and Mechanics College of Engineering

**160 Engineering Graphic Communications**  
Fall, Spring. 3(1-4) P:M: (MTH 116 or concurrently or LBS 117 or concurrently or MTH 132 or concurrently) or (MTH 103 and MTH 114 or concurrently)

Computer-aided design and drafting. Freehand sketching. Two and three dimensional visualization. Blueprint reading. Geometric dimensioning and tolerancing. Introduction to engineering design.

**205 Statics**  
Fall, Spring. 3(3-0) P:M: (MTH 132 or LBS 118)

Vector description of forces and moments. Two and three dimensional equilibrium of particles and rigid bodies. Analysis of trusses, frames and machines. Coulomb friction.

**206 Introduction to Solid Mechanics**  
Spring. 4(4-0) P:M: (MTH 133 or MTH 153H or LBS 119) R: Not open to students in the Civil Engineering or Engineering Arts or Engineering Mechanics or Manufacturing Engineering or Materials Science and Engineering or Mechanical Engineering major. Not open to students with credit in MSM 211 or MSM 205.

Statics: moment and force resultants, equilibrium. Mechanics of deformable bodies: stress and strain, classification of material behavior, generalized Hooke's law. Engineering applications: axial loads, torsion of circular rods and tubes, bending and shear stresses in beams, deflection of beams, combined stresses, stress and strain transformation.

**211 Mechanics of Deformable Solids**  
Fall, Spring. 3(3-2) P:M: (MSM 205) and (MTH 133 or concurrently or LBS 119 or concurrently)

Tension compression and shear stresses. Axially loaded bars. Torsion of circular shafts. Beam theory. Combined stresses. Mohr's circles. Columns.

- 250 Materials Science and Engineering**  
Fall, Spring. 3(3-2) P:M: (CEM 141 or CEM 151 or LBS 165)  
Structure of metals, ceramics and polymers. Phase diagrams, thermomechanical treatments, physical and mechanical properties, diffusion, microstructure studies, environmental effects.
- 260 Computer Aided Design Tools**  
Spring. 3(1-4) P:M: (MSM 160) R: Open only to students in Manufacturing Engineering and Engineering Arts-Product Design cognate.  
Advanced 3D solid modeling, CNC programming, and rapid prototyping.
- 300 Technology, Society and Public Policy**  
Fall. 2(2-0) P:M: Completion of Tier I writing requirement. P:NM: Two courses in mathematics or engineering or science. SA: EGR 200  
Defining, describing and analyzing technology. Impact of technology on society. Public policy and technology. Short history of technology. Development and use of assessment tools to measure impact and consequences of technology.
- 306 Dynamics**  
Fall, Spring. 3(3-0) P:M: (MSM 205) and (MTH 235 or LBS 220) R: Open only to students in the College of Engineering.  
Kinematics of particles, rigid bodies, and mass moments of inertia. Kinetics of particles and rigid bodies. Energy and momentum principles.
- 351 Thermochemistry of Materials**  
Fall. 3(3-0) P:M: (CEM 151 or CEM 141 or LBS 165) and (MTH 234 or LBS 220) Not open to students with credit in BE 351 or CHE 321 or ME 201.  
State variables, laws of thermodynamics, phase and chemical equilibria. Gas and condensed phase relationships, solutions, interfaces, point defects, electrochemistry.
- 352 Diffusion in Solids**  
Spring. 3(3-0) P:M: (MSM 250) and (MSM 351 or ME 201) R: Open only to students in the Materials Science and Engineering major.  
Diffusion and mass transport. Kinetics of diffusion-controlled processes. Point defects, nucleation and growth, interface motion.
- 355 Mechanical Behavior of Materials**  
Fall. 3(3-0) P:M: (MSM 211 and MSM 250) R: Open only to students in the Department of Materials Science and Mechanics or Department of Mechanical Engineering.  
Stress and strain, crystal elasticity, anelasticity and viscoelasticity. Mechanical properties in tension and torsion. Crystallographic aspects of plasticity.
- 356 Deformation Mechanisms**  
Spring. 3(3-0) P:M: (MSM 355) R: Open only to students in the Materials Science and Engineering major.  
Elementary dislocation theory, slip and twinning. Deformation of single and polycrystals. Temperature and strain rate effects. Work hardening, solution and particle strengthening. Creep, fatigue and fracture in metals, ceramics and polymers.
- 360 Introduction to Product Design**  
Fall. 3(1-4) P:M: (STA 110) R: Open only to students in Manufacturing Engineering and Engineering Arts-Product Design cognate.  
Ideation methods, design methodology, 3-D model building, small-scale group and individual projects. Project presentations.
- 361 Computer Aided Product Design**  
Spring. 3(1-4) P:M: (MSM 260 or concurrently and MSM 360) R: Open only to students in Manufacturing Engineering and Engineering Arts-Product Design cognate.  
Freeform modeling techniques. Top down product design. Use of computer tools to assist in the development of products.
- 365 Physical Metallurgy I**  
Fall. 3(3-0) P:M: (MSM 250) and (MSM 351 or concurrently or ME 201 or concurrently) R: Open only to students in the Engineering Mechanics or Materials Science and Engineering major.  
Complex binary and ternary phase diagrams. Solidification. Recovery, recrystallization and grain growth. Phase transformations.
- 375 Materials Science Laboratory I**  
Fall. 1(0-3) P:M: (MSM 355 or concurrently) R: Open only to students in the Engineering Mechanics or Materials Science and Engineering major.  
Phase transformations. Recrystallization. Precipitation and aging. Microscopy. Structure-property relations.
- 376 Materials Science Laboratory II**  
Spring. 1(0-3) P:M: (MSM 355) R: Open only to students in the Materials Science and Engineering or Engineering Mechanics major.  
Strengthening. Yielding, creep, and fracture. Plasticity. Thermal activation. Damping. Martensite and shape memory.
- 380 Polymeric Materials**  
Spring. 3(3-0) P:M: (CEM 151 or CEM 141 or LBS 165) and (ME 201 or concurrently or MSM 351 or concurrently) R: Open only to students in the Department of Materials Science and Mechanics.  
Polymers and engineering plastics. Chemical, physical and mechanical properties. Environmental effects on polymers. Manufacturing processes. Coatings.
- 400 System Methodology**  
Spring. 2(1-3) P:M: (MSM 300) SA: SYS 410  
System analysis and design. Needs analysis, system identification, graphical models. Team project required.
- 401 Intermediate Mechanics of Deformable Solids**  
Fall. 3(3-0) P:M: (MSM 211) R: Open only to students in the College of Engineering.  
Stress, strain and linearly elastic behavior. Plane stress and plane strain. Torsion. Yield criteria. Elastoplastic behavior of beams, shafts and cylinders. Unsymmetrical bending. Curved beams.
- 402 Computational Mechanics**  
Spring. 3(3-0) P:M: (MSM 401 or ME 471) R: Open only to students in the College of Engineering.  
Energy methods with applications. Finite element methods. Buckling and stability. Green's functions.
- 403 Intermediate Dynamics**  
Fall of even years. 3(3-0) P:M: (MSM 306) R: Open only to students in the College of Engineering.  
Kinematics and kinetics of particle and rigid body systems. Virtual work, Lagrangian method, and Euler equations. Basic vibrations of discrete and continuous systems. Elementary wave propagation.
- 405 Experimental Mechanics**  
Fall of odd years. 3(2-3) P:M: (MSM 211) R: Open only to students in the College of Engineering.  
Measurement of stress, strain, vibration, and motion using strain gauges, accelerometers, photoelasticity, holography, Moire patterns, laser speckle and electronic imaging. Transducer design.
- 424 Biomaterials and Biocompatibility**  
Spring of even years. 3(3-0) Interdepartmental with Biomedical Engineering. P:M: (PSL 250 and MSM 250)  
Materials science of human implants. Design requirements imposed by the body's milieu and the need to protect the body.
- 441 Tissue Mechanics**  
Spring of odd years. 3(3-0) Interdepartmental with Biomedical Engineering. P:M: (MSM 211)  
Application of solid mechanics to understanding mechanical responses of biological tissues. Microstructure and biological function for soft and hard connective tissues and muscle.
- 442 Biodynamics**  
Fall. 3(2-2) Interdepartmental with Materials Science and Mechanics; Biomedical Engineering. Administered by Department of Materials Science and Mechanics. P:M: (MSM 306) R: Open only to students in the Engineering Mechanics major.  
Fundamentals of motion analysis of human movement and its application to the study of function and dysfunction of the musculoskeletal system. Solution methods of the inverse dynamics problem.
- 444 Introduction to Composite Materials**  
Spring. 3(3-0) P:M: (MSM 211) R: Open only to students in the Department of Materials Science and Mechanics.  
Constituents and interfacial bonding. Manufacturing techniques. Microstructure and micromechanics. Theory of anisotropy. Classical laminate theory. Material characterization. Failure and damage. Composite structure design.
- 445 Biomechanical Design**  
Spring. 3(3-0) Interdepartmental with Biomedical Engineering. R: Open only to juniors or seniors in the College of Engineering. SA: BME 491A  
Biomechanical product design with application to people or animals. Synthesis, prototyping, and analysis of designs. Project management. Market research.
- 451 X-Ray Crystallography**  
Fall. 3(2-3) P:M: (MSM 250) and (PHY 184 or PHY 184B or concurrently) R: Open only to seniors in the Materials Science and Engineering major or to graduate students in the Materials Science major.  
General properties, generation and detection of x rays. Interaction with solids. Crystallography, reciprocal lattice, diffraction analysis and techniques. Single crystal methods, stereographic projection. X ray microanalysis.
- 454 Ceramic and Refractory Materials**  
Fall. 3(3-0) P:M: (MSM 365) R: Open only to students in the Engineering Mechanics or Materials Science and Engineering or Materials Science major.  
Ceramic and glassy materials. High temperature processes. Mechanical and physical properties of technical ceramics.

## Materials Science and Mechanics—MSM

- 455 Theory of Solids**  
Fall. 3(3-0) P:M: (MSM 250) and (PHY 184 or PHY 184B or concurrently) R: Open only to students in the Engineering Mechanics or Materials Science and Engineering or Materials Science major.  
Atomic theory of materials. Free electron theory of metals. Electrons in a periodic field. Insulators, semiconductors. Thermal properties. Dielectric and magnetic behavior. Superconductivity.
- 465 Design and Application of Engineering Materials**  
Spring. 3(3-0) P:M: (MSM 355 and MSM 365) R: Open only to students in the Engineering Mechanics or Materials Science and Engineering or Materials Science major.  
Fundamental principles of strengthening; toughening, specific strength and stiffness. Material development based on environmental, temperature, wear, damping, fatigue and economic considerations.
- 466 Failure Analysis**  
Spring. 3(2-2) P:M: (MSM 355) R: Open only to students in the Department of Materials Science and Mechanics.  
Modes and causes of failure in mechanical components. Non-destructive evaluation. Legal and economic aspects of materials failure. Analysis illustrated through student projects requiring integration of knowledge from several courses.
- 476 Physical Processing of Materials**  
Fall of even years. 3(3-0) P:M: (MSM 365) R: Open only to students in the Materials Science and Engineering or Materials Science major.  
Heat treatment and properties of ferrous alloys. Casting and solidification. Effects of alloying elements, high strength low alloy steels, hardenability, case hardening. Joining of materials, welding.
- 480 Chemical Processing of Materials**  
Fall of even years. 3(3-0) P:M: (MSM 352 or CHE 312) R: Open only to students in the Department of Materials Science and Mechanics or Department of Chemical Engineering.  
Processing of metals, ceramics, and polymers. Material and energy balances. Reduction and oxidation. Extractive technology of iron, steel, and principal non-ferrous metals. Colloidal preparation of ceramics.
- 481 Manufacturing Processes**  
Fall. 3(3-0) P:M: (MSM 211 and MSM 250) and completion of Tier I writing requirement. R: Open only to students in the Department of Materials Science and Mechanics.  
Fundamentals of manufacturing processes such as casting, heat treating, particulate processing, forming, machining, joining and surface processing. Selection of manufacturing processes based on design and materials.
- 482 Product Development**  
Spring. 3(3-0) P:M: (MSM 306 and MSM 481) and completion of Tier I writing requirement.  
Simulation of industrial environment for product development. Product concept, design and manufacturing.
- 483 Environmental Effects on Materials**  
Fall of odd years. 3(3-0) P:M: (MSM 352) R: Open only to students in the Materials Science and Engineering or Materials Science major.  
Electrochemical processes and kinetics. Metallic corrosion and protection. Degradation of ceramics, polymers and composites.
- 490 Independent Study**  
Fall, Spring, Summer. 1 to 3 credits. A student may earn a maximum of 6 credits in all enrollments for this course. R: Open only to juniors or seniors in the College of Engineering. Approval of department.  
Individualized reading and research.
- 491 Selected Topics**  
Fall, Spring, Summer. 1 to 3 credits. A student may earn a maximum of 6 credits in all enrollments for this course. R: Open only to students in the Department of Materials Science and Mechanics.  
Topics in materials science or mechanics of current interest.
- 499 Senior Research and Design Project (W)**  
Fall, Spring, Summer. 2 to 4 credits. A student may earn a maximum of 6 credits in all enrollments for this course. P:M: Completion of Tier I writing requirement. R: Open only to seniors in the Engineering Mechanics or Materials Science and Engineering or Engineering Arts major. Approval of department.  
Design and analysis to solve materials and/or mechanics related problem. Preparation of written report, oral presentation, and defense of the project.
- 801 Advanced Dynamics**  
Fall. 3(3-0)  
Dynamics of systems of particles and rigid bodies. Energy and momentum principles. Lagrangian and Hamiltonian methods. Euler angles. Applications in system dynamics and vibrations.
- 805 Experimental Mechanics**  
Spring. 3(2-3) R: Approval of department.  
Measurement of strain, displacement, velocity, acceleration using resistance strain gages, accelerometers, and related methods. Detailed study of strain gages and accelerometers. Transducer design. Basic modal analysis.
- 809 Finite Element Method**  
Fall, Spring. 3(3-0) Interdepartmental with Civil Engineering; Mechanical Engineering; Biosystems Engineering. SA: AE 809  
Theory and application of the finite element method to the solution of continuum type problems in heat transfer, fluid mechanics, and stress analysis.
- 810 Continuum Mechanics**  
Fall. 3(3-0)  
Mathematical tools of continuum mechanics, stress principles, kinematics of deformation and motion, fundamental laws and equations. Applications in linear elasticity and classical fluids.
- 813 Linear Elasticity**  
Spring. 3(3-0) P:NM: (MSM 810)  
Fundamentals of isotropic linear elasticity. Solution of plane elasticity problems. St. Venant bending and torsion. Singular solutions. Basic three-dimensional solutions.
- 814 Laminated Composite Materials**  
Fall of even years. 3(3-0) A student may earn a maximum of 6 credits in all enrollments for this course. P:M: (MSM 810)  
Fundamentals of anisotropic elasticity and their application to laminated composite plates. Unique states of deformation, stress, and failure not encountered in isotropic, homogeneous materials.
- 815 Advanced Strength of Materials**  
Spring of odd years. 3(3-0)  
General theory of torsion, nonsymmetric bending, transverse shear, thin-walled beams, beams on elastic foundations, thick-walled cylinders. Basic contact mechanics. Failure criteria for solids.
- 816 Fracture Mechanics and Fatigue**  
Spring of even years. 3(3-0) P:NM: (MSM 813)  
Brittle and ductile fracture. Elastic stress fields near cracks. Elastic-plastic analysis of crack extension. Plastic instability. Cyclic crack propagation. Models of cyclic deformation and fatigue failure. Environmental effects. Case studies.
- 817 Plasticity**  
Spring of odd years. 3(3-0) P:NM: (MSM 813)  
Yield conditions, stress-strain relations, plastic potential, hardening theories, torsion, bending. Thick walled shells under internal pressure. Limit analysis. Slip line theory.
- 818 Micromechanics of Materials**  
Fall of odd years. 3(3-0) P:M: (MSM 870)  
Microscopic analysis of cellular solids, polycrystals and composite materials. Homogenization techniques for finding effective properties of inhomogeneous materials.
- 820 Energy Methods in Mechanics**  
Spring of even years. 3(3-0) P:NM: (MSM 813)  
Calculus of variations. Variational principles in mechanics. Approximate methods. Energy criteria for stability. Applications to structural dynamics.
- 851 Thermodynamics of Solids**  
Fall. 3(3-0)  
Use of Jacobians. Thermodynamic functions. Thermodynamics of solid-solid phase transformation. Thermoelastic solids, rubber elasticity, and stressed solids. Surfaces and interfaces, point defects in solids. Thermodynamics of solids under high pressure.
- 855 Advanced Rate Theory and Diffusion**  
Spring. 3(3-0) P:NM: (MSM 851)  
Review of Fick's Laws. Atomistic aspects of diffusion. Defects in solids. Probabilistic basis of random walk. Green's function solutions.
- 860 Theory of Vibrations**  
Fall. 3(3-0) Interdepartmental with Mechanical Engineering. Administered by Department of Mechanical Engineering.  
Discrete systems and continua. Analytical mechanics. Variational principles. Modal analysis. Function spaces. Eigenfunction expansions. Integral transforms. Stability. Approximations. Perturbations.
- 862 Dislocation Theory**  
Fall. 3(3-0)  
Advanced theory of dislocations and other crystal defects in metals, ceramics, aggregates and ordered compounds. Elasticity theory of straight dislocations, dislocation strain energy, mobility, obstacle interactions, reactions, and core effects.

## MATHEMATICS MTH

### Department of Mathematics College of Natural Science

- 100E Intermediate Algebra Workshop for the Mathematics Enrichment Program**  
Fall, Spring. 1(0-4) R: Approval of department. C: MTH 1825 concurrently.  
Enrichment topics in intermediate algebra for students in the Mathematics Enrichment Program.
- 103 College Algebra**  
Fall, Spring, Summer. 3(3-0) P:M: (MTH 1825) or designated score on Mathematics placement test. Not open to students with credit in LBS 117 or MTH 110 or MTH 116 or MTH 120.  
Number systems; functions and relations; exponents and logarithms; elementary theory of equations; inequalities; and systems of equations.
- 103E College Algebra Workshop for the Mathematics Enrichment Program**  
Fall, Spring. 1(0-4) R: Approval of department. C: MTH 103 concurrently.  
Enrichment topics in college algebra for students in the Mathematics Enrichment Program.
- 106 The Significance of Mathematics**  
Fall, Spring, Summer. 3(3-0) P:M: (MTH 103) or designated score on Mathematics placement test.  
Numbers and numeracy, geometry, growth patterns, and statistics. Selected applications to the arts, sciences, and social sciences.
- 106E The Significance of Mathematics Workshop for the Mathematics Enrichment Program**  
Spring. 1(0-4) R: Approval of department C: MTH 106 concurrently.  
Enrichment topics in The Significance of Mathematics for the Math Enrichment Program.
- 110 College Algebra and Finite Mathematics**  
Fall, Spring, Summer. 5(5-0) P:M: (MTH 1825) or designated score on Mathematics placement test. Not open to students with credit in LBS 117 or MTH 103 or MTH 116 or MTH 120.  
Functions and graphs. Equations and inequalities. Systems of equations. Matrices. Linear programming. Simplex algorithm. Probability and statistics.
- 114 Trigonometry**  
Fall, Spring, Summer. 3(3-0) P:M: (MTH 103 or MTH 110) Not open to students with credit in MTH 116.  
Radian and degree measure of angles. Definitions and graphs of trigonometric functions and their inverses. Solving trigonometric equations. Applications including identities, indirect measurement and trigonometric modeling.
- 116 College Algebra and Trigonometry**  
Fall, Spring, Summer. 5(5-0) P:M: (MTH 1825) or designated score on Mathematics placement test. Not open to students with credit in LBS 117 or MTH 103 or MTH 116 or MTH 120.  
Functions and graphs. Equations and inequalities. Exponential and logarithmic functions. Trigonometric functions. Systems of equations. Binomial theorem.

- 865 Advanced Theory of Solids**  
Spring. 3(3-0)  
Quantum mechanics. Free electron theory. Energy bands, semiconductors. Dielectrics and ferroelectrics. Dia-, para-, ferro-, and antiferro-magnetism. Superconductivity. Thermal properties.
- 870 Electron Microscopy in Materials Science**  
Spring. 3(2-3) R: Open only to graduate students in a Materials Science major or approval of department.  
Theory of electron diffraction. Electromagnetic lenses. Image formation in transmission electron microscopy. Defect analysis and diffraction contrast.
- 871 Material Surfaces and Interfaces**  
Fall of odd years. 3(3-0) Interdepartmental with Chemical Engineering. P:NM: (CEM 362 or MSM 351) R: Open only to graduate students in the Department of Chemical Engineering or Department of Chemistry or Department of Materials Science and Mechanics or School of Packaging.  
Physical and chemical nature of solid surfaces and their interaction with gases, liquids, and other solids. Characterization of surfaces and solid-solid interfaces. Relation of surface and interfacial structure to engineering phenomena.
- 875 Engineering Ceramics**  
Fall of odd years. 3(3-0) P:NM: (MSM 851)  
Physical properties of engineering ceramics. Transport properties of ceramics, especially in ferrites and garnets. Optical ceramic materials.
- 876 Advanced Polymeric Materials**  
Fall of even years. 3(3-0)  
Advanced topics in polymer structure and properties. Thermoplastics, thermosets, polyblends and elastomers. Processing techniques. Deformation and mechanical properties. Thermal, optical and chemical properties. Composites.
- 885 Seminar**  
Fall, Spring. 1(1-0)  
Oral presentations of students' research or literature survey.
- 890 Independent Study**  
Fall, Spring, Summer. 1 to 3 credits. A student may earn a maximum of 6 credits in all enrollments for this course. R: Approval of department.  
Individualized reading and research of student's interest.
- 891 Selected Topics**  
Fall, Spring, Summer. 1 to 3 credits. A student may earn a maximum of 6 credits in all enrollments for this course. R: Approval of department.  
Special topics in materials science or mechanics of current importance.
- 899 Master's Thesis Research**  
Fall, Spring, Summer. 1 to 8 credits. A student may earn a maximum of 24 credits in all enrollments for this course.  
Master's thesis research.
- 905 Optical Methods of Measurement**  
Fall of even years. 3(2-3) R: Approval of department.  
Measurement of dimension, position, motion, strain, using optical methods including holography, speckle interferometry, Moire, photoelasticity, laser Doppler, electronic imaging, model analysis. Relevant optics theory.
- 915 Nonlinear Elasticity**  
Spring of even years. 3(3-0) P:NM: (MSM 813)  
Kinematics and kinetics of large deformations. Incompressible and compressible finite elasticity. Solution of basic problems. Nonuniqueness, stability and buckling. Singular fields near cracks and flaws.
- 918 Thermoelasticity and Viscoelasticity**  
Spring of even years. 3(3-0) P:NM: (MSM 810 and MTH 443)  
Thermomechanics of solids. Theory of thermoelasticity. Boundary value problems in thermoelasticity. Linear and nonlinear viscoelasticity. Model representation. Boltzmann superposition. Correspondence principle.
- 964 Advanced Physical and Mechanical Properties of Materials I (MTC)**  
Fall of even years. 3(3-0) A student may earn a maximum of 9 credits in all enrollments for this course. SA: MSM 960  
Topics vary each semester. Topics such as anisotropic crystalline properties and displacive phase transformations.
- 965 Advanced Analytical Techniques (MTC)**  
Fall of odd years. 3(3-0) A student may earn a maximum of 9 credits in all enrollments for this course. SA: MSM 970  
Topics vary each semester. Topics such as environmental effects on materials and advanced techniques in electron microscopy.
- 974 Advanced Physical and Mechanical Properties of Materials II (MTC)**  
Spring of even years. 3(3-0) A student may earn a maximum of 9 credits in all enrollments for this course. SA: MSM 960  
Topics vary each semester. Topics such as microcracking in brittle materials, or high temperature deformation and processing.
- 975 Advanced Processing Techniques (MTC)**  
Spring of odd years. 3(3-0) A student may earn a maximum of 9 credits in all enrollments for this course. SA: MSM 980  
Topics vary each semester. Topics such as laser and plasma processing and ceramic processing.
- 990 Independent Study**  
Fall, Spring, Summer. 1 to 3 credits. A student may earn a maximum of 6 credits in all enrollments for this course.  
Individualized reading and research.
- 991 Selected Topics**  
Fall, Spring, Summer. 1 to 3 credits. A student may earn a maximum of 6 credits in all enrollments for this course. R: Approval of department.  
Special advanced topics in materials science and engineering, and mechanics.
- 999 Doctoral Dissertation Research**  
Fall, Spring, Summer. 1 to 24 credits. A student may earn a maximum of 72 credits in all enrollments for this course.  
Doctoral dissertation research.