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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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. P:NM: 12 credits graduate course work R: Open only to graduate students in the College of Business.

891 Special Topics in Business Management
Fall, Spring. 1 to 3 credits. A student may earn a maximum of 6 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.

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.

MATERIALS SCIENCE AND MECHANICS

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). 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.


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.
MSM–Materials Science and Mechanics

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 engineering or science. SA: EGR 200

306 Dynamics
Fall. Spring. 3(3-0) P.M: (MSM 205) and (MTH 232 or LBS 222) 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) R: Open not 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, 3D 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.

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.

376 Materials Science Laboratory II
Spring. 1(0-3) P.M: (MSM 355) R: Open only to students in the Materials Science and Engineering Mechanics major.

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.

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
Spring. 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. Elastic-plastic 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.

403 Intermediate Dynamics
Fall of even years. 3(3-0) P.M: (MSM 306) R: Open only to students in the College of Engineering.

405 Experimental Mechanics
Fall of odd years. 3(3-2) 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, photelasticity, holography, Moiré 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 Engineering, Biomedical Engineering, Administered by Department of Materials Science and Science. (MSM 306) R: Open only to students in the Engineering Mechanics major.

444 Introduction to Composite Materials

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.

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.
Fundamental principles of strengthening; toughening, specific strength and stiffness. Material development based on environmental, temperature, wear, damping, fatigue and economic considerations.

456 Design and Application of Engineering Materials
Spring. 3(3-0) P:M: (MSM 355 and MSM 385) R: Open only to students in the Engineering Mechanics or Materials Science and Engineering or Materials Science major.

465 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 Department of Materials Science and Engineering.

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 Chemistry.

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.

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. 3(2-2) P:M: (MSM 355 and MSM 385) R: Open only to students 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.

499A Senior Research and Design Project (R)
Fall of odd years. 3(3-0) R: Open only to students in the Materials Science and Engineering or Engineering Arts major. Approval of department.

501 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.

801 Advanced Dynamics
Fall. 3(3-0)

811 Thermodynamics of Solids
Fall. 3(3-0)

813 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:M: (MSM 813)

817 Plasticity
Spring of odd years. 3(3-0) P:M: (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:M: (MSM 813)

851 Thermodynamics of Solids
Fall. 3(3-0)

855 Advanced Rate Theory and Diffusion
Spring. 3(3-0) P:M: (MSM 851)

860 Theory of Vibration
Fall. 3(3-0) Interdepartmental with Mechanical Engineering. Administered by Department of Mechanical Engineering.

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.
915 Nonlinear Elasticity
Spring of even years. 3(3-0) P:NM. (MSM 813)

918 Thermoelasticity and Viscoelasticity
Spring of even years. 3(3-0) P:NM. (MSM 810 and MTH 443)

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. R: Approval of department. Individualized reading and research of student's interest.

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 topics in materials science or mechanics of current importance.

999 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.

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.