

**Descriptions—Marketing and Logistics
of
Courses**

930. Theory of Transportation-Distribution Systems

Fall of odd-numbered years. 3(3-0)
P: ML 805. R: Open only to Ph.D. students in the College of Business.
Transportation-distribution research on systems integration. Elements of networks, systems, and economic theory in the design, evaluation, and control of logistics systems. Topics include strategic logistics, forecasting, and system integration models.
QP: MTA 809 QA: MTA 930

931. Transportation and Distribution Research Methods

Spring of even-numbered years. 3(3-0)
P: ML 930. R: Open only to Ph.D. students in Business.
Techniques and methodology of system design, customer service and policy formulation.
QP: MTA 930 QA: MTA 931

932. Transportation and Distribution Development Policy

Fall of even-numbered years. 3(3-0)
P: ML 805. R: Open only to Ph.D. students in College of Business.
The interaction of government, carrier, and user logistics and distribution strategies, particularly at the macro-corporate and national policy levels.
QP: MTA 931 QA: MTA 932

940. International Business Theory

Fall of even-numbered years. 3(3-0)
P: ML 860 or ML 862.
Theories explaining international business phenomena. Varying perspectives on international business activities, concepts, and frameworks.
QP: MTA 860 or MTA 862

941. International Business Research Issues

Spring of even-numbered years. 3(3-0)
P: ML 940.
Scientific methods of research on international business. Topics include cultural bias and organizing multi-country studies.
QP: MTA 862 QA: MTA 863

995. Directed Research Paper

Fall, Spring, Summer. 1(1-0)
P: ML 921. R: Open only to Ph.D. students in Marketing and Transportation Administration.
Production of research paper under the direction of a senior faculty member.
QP: MTA 921

999. Doctoral Dissertation Research

Fall, Spring, Summer. 1 to 24 credits. A student may earn a maximum of 99 credits in all enrollments for this course.
R: Approval of department.

QA: MTA 999

MATERIALS SCIENCE AND MECHANICS MSM

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

160. Engineering Communications

Fall, Spring. 3(2-3)
P: MTH 116 or concurrently.
Computer-aided design and drafting. Freehand sketching. Two and three dimensional visualization. Preparation of spread sheets and technical reports.
QA: MMM 160

205. Statics

Fall, Spring. 3(3-0)
P: MTH 132.
Vector description of forces and moments. Two and three dimensional equilibrium of particles and rigid bodies. Analysis of trusses, frames and machines. Coulomb friction.
QP: MTH 215 QA: MMM 205

211. Mechanics of Deformable Solids

Fall, Spring. 3(3-2)
P: MSM 205, MTH 133 or concurrently.
Tension compression and shear stresses. Axially loaded bars. Torsion of circular shafts. Beam theory. Combined stresses. Mohr's circles. Columns.
QP: MMM 205, MTH 310, MMM 215 QA: MMM 211, MMM 215

250. Materials Science and Engineering

Fall, Spring. 3(3-2)
P: CEM 141, MTH 133.
Structure of metals, ceramics and polymers. Phase diagrams, thermomechanical treatments, physical and mechanical properties, diffusion, microstructure studies, environmental effects.
QP: CEM 141, MTH 113 QA: MMM 250, MMM 230

306. Dynamics

Fall, Spring. 3(3-0)
P: MSM 205, MTH 235. R: Open only to College of Engineering students.
Kinematics of motion. Mass moments of inertia. Kinetics of particles and rigid bodies. Energy and momentum principles.
QP: MMM 205, MTH 310 QA: MMM 306

351. Thermochemistry of Materials

Fall. 3(3-0)
P: CEM 152, MTH 234. R: Open only to Materials Science and Engineering majors. Not open to students with credit in CHE 311, ME 201.
State variables, laws of thermodynamics, phase and chemical equilibria. Gas and condensed phase relationships, solutions, interfaces, point defects, electrochemistry.
QP: CEM 152, MTH 215 QA: MMM 330

352. Diffusion in Solids

Spring. 3(3-0)
P: MSM 250, MSM 351. R: Open only to Materials Science and Engineering majors.
Diffusion and mass transport. Kinetics of diffusion-controlled processes. Point defects, nucleation and growth, interface motion.
QP: MMM 330 QA: MMM 452

355. Mechanical Behavior of Materials

Fall. 3(3-0)
P: MSM 211, MSM 250. C: MSM 375 R: Open only to Materials Science and Engineering, Mechanical Engineering majors.
Stress and strain, crystal elasticity, anelasticity and viscoelasticity. Mechanical properties in tension and torsion. Crystallographic aspects of plasticity.
QP: MMM 211, MMM 250 QA: MMM 350, MMM 351

356. Deformation Mechanisms

Spring. 3(3-0)
P: MSM 355. R: Open only to Materials Science and Engineering majors.
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.
QP: MMM 350, MMM 351 QA: MMM 351, MMM 456

365. Physical Metallurgy I

Fall. 3(3-0)
P: MSM 250, MSM 351 or concurrently. C: MSM 375 R: Open only to Materials Science and Engineering majors.
Complex binary and ternary phase diagrams. Solidification. Recovery, recrystallization and grain growth. Phase transformations.
QP: MMM 250, MMM 330, MMM 360 QA: MMM 360, MMM 361

366. Physical Metallurgy II

Spring. 3(3-0)
P: MSM 365. C: MSM 376 R: Open only to Materials Science and Engineering majors.
Theory of alloy phases. Surfaces and interfaces. Diffusion controlled phase transformations in ferrous and non-ferrous alloys. Martensitic transformation. Amorphous structures.
QP: MMM 360, MMM 330 QA: MMM 453, MMM 361

375. Materials Science Laboratory I

Fall. 1(0-3)
P: MSM 355; C: MSM 365 R: Open only to Materials Science and Engineering majors.
Phase transformations. Recrystallization. Precipitation and aging. Microscopy. Structure-property relations.
QP: MMM 350, MMM 360 QA: MMM 362

376. Materials Science Laboratory II

Spring. 1(0-3)
P: MSM 356 or concurrently. R: Open only to Materials Science and Engineering majors.
Strengthening. Yielding, creep, and fracture. Plasticity. Thermal activation. Damping. Marsensite and shape memory.
QP: MMM 350, MMM 360 QA: MMM 352

380. Polymeric Materials

Spring. 3(3-0)
P: CEM 152. R: Open only to Materials Science and Engineering majors.
Polymers and engineering plastics. Chemical, physical and mechanical properties. Environmental effects on polymers. Manufacturing processes. Coatings.
QP: CEM 152

401. Intermediate Mechanics of Deformable Solids

Fall. 3(3-0)
P: MSM 211. R: Open only to College of Engineering majors.
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.
QP: MMM 211 QA: MMM 401

402. Computational Mechanics

Spring. 3(3-0)
P: MSM 401, ME 471. R: Open only to College of Engineering majors.
Energy methods with applications. Finite element methods. Buckling and stability. Green's functions.
QP: MMM 401 QA: MMM 402

403. Intermediate Dynamics

Fall of even-numbered years. 3(3-0)
P: MSM 306. R: Open only to College of Engineering majors.
Kinematics and dynamics of particle and rigid body systems. Virtual work, Lagrangian method, Euler equations. Basic vibrations of discrete and continuous systems. Elementary wave propagation.
QP: MMM 306 QA: MMM 403

405. Experimental Mechanics

Fall of odd-numbered years. 3(2-3)
P: MSM 211, MSM 306. R: Open only to College of Engineering majors.
Measurement of stress, strain, vibration, and motion using strain gauges, accelerometers, photoelasticity, holography, Moire patterns, laser speckle and electronic imaging. Transducer design.
QP: MMM 211, MMM 215, MMM 306 QA: MMM 405

444. Introduction to Composite Materials

Spring. 3(3-0)
P: MSM 211. R: Open only to Materials Science and Engineering or Mechanics majors or approval of department.
Constituents and interfacial bonding. Manufacturing techniques. Microstructure and micromechanics. Theory of anisotropy. Classical laminate theory. Material characterization. Failure and damage. Composite structure design.
QP: MMM 211 QA: MMM 444

451. X-Ray Crystallography

Fall. 3(2-3)
P: MSM 250. R: Open only to Materials Science and Engineering seniors and graduate students.
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.
QP: MMM 250 QA: MMM 430

- 454. Ceramic and Refractory Materials**
Fall, 3(3-0)
P: MSM 250, MSM 351. R: Open only to Materials Science and Engineering majors.
Ceramic and glassy materials. High temperature processes. Mechanical and physical properties of technical ceramics.
QP: MMM 250 QA: MMM 420
- 455. Theory of Solids**
Spring, 3(3-0)
P: MSM 451. R: Open only to Materials Science and Engineering majors.
Atomic theory of materials. Free electron theory of metals. Electrons in a periodic field. Insulators, semiconductors. Thermal properties. Dielectric and magnetic behavior. Superconductivity.
QP: MMM 430, PHY 289 QA: MMM 454
- 465. Design and Application of Engineering Materials**
Spring, 3(3-0)
P: MSM 356, MSM 365. R: Open only to Materials Science and Engineering majors.
Fundamental principles of strengthening; toughening, specific strength and stiffness. Material development based on environmental, temperature, wear, damping, fatigue and economic considerations.
QP: MMM 330, MMM 456 QA: MMM 476
- 466. Failure Analysis**
Spring, 3(3-0)
P: MSM 211, MSM 250. R: Open only to Materials Science and Engineering or Mechanics majors or approval of department.
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.
QP: MMM 211, MMM 215, MMM 250 QA: MMM 425, MMM 465
- 475. Deformation Processing of Materials**
Fall of odd-numbered years. 3(3-0)
P: MSM 355. R: Open only to Material Science and Engineering, Mechanical Engineering majors.
Theories of metal forming. Forging, rolling, extrusion, wire drawing, sheet metal forming, machining, powder pressing, sintering, hot pressing, composite processing.
QP: MMM 350 QA: MMM 462, MMM 481
- 476. Physical Processing of Materials**
Spring of odd-numbered years. 3(3-0)
P: MSM 365. R: Open only to College of Engineering majors.
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.
QP: MMM 350, MMM 360 QA: MMM 461, MMM 463
- 480. Chemical Processing of Materials**
Fall, 3(3-0)
P: MSM 352, or CHE 312. R: Open only to Materials Science and Engineering, and Chemical Engineering seniors and graduate students.
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.
QP: MMM 330 QA: MMM 480
- 481. Manufacturing Systems I**
Fall, 3(3-0)
P: MSM 205, MSM 250. R: Open only to Materials Science and Engineering or Engineering Arts majors.
Manufacturing process planning and design. Discrete parts and assembly processes. Productivity, cost estimation, time standards, materials handling, plant layout principles.
QP: MMM 201, MMM 205, MMM 230, MMM 250 QA: MMM 421, MMM 442
- 482. Manufacturing Systems II**
Spring, 3(3-0)
P: MSM 481. R: Open only to Materials Science and Engineering or Engineering Arts majors.
Operations scheduling and control. Applications of artificial intelligence. Optimization of multiple stage manufacturing activities. Manufacturing resource planning. Principles of synchronous manufacturing.
QP: MMM 205, MMM 421 QA: MMM 422, MMM 442
- 483. Environmental Effects on Materials**
Spring of odd-numbered years. 3(3-0)
P: MSM 352. R: Open only to Materials Science and Engineering majors.
Electrochemical processes and kinetics. Metallic corrosion and protection. Degradation of ceramics, polymers and composites.
QP: MMM 330 QA: MMM 431
- 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 Materials Science and Engineering majors. Approval of department.
Individualized reading and research.
QA: MMM 400
- 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 majors in Materials Science and Engineering or in Mechanics.
Topics in materials science or mechanics of current interest.
- 499. Senior Research and Design Project**
Fall, Spring, Summer. 2 to 4 credits. A student may earn a maximum of 6 credits in all enrollments for this course.
R: Open only to seniors in Materials Science and Engineering, Engineering Arts, and Mechanics. Approval of department.
Design and analysis to solve a materials related problem.
QA: MMM 499
- 801. Advanced Dynamics**
Fall, 3(3-0)
P: MSM 403.
Dynamics of systems of particles and rigid bodies. Energy and momentum principles. Lagrangian and Hamiltonian methods. Euler angles. Applications in system dynamics and vibrations.
QP: MMM 306 QA: MMM 801
- 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.
QA: MMM 805
- 809. Finite Element Method**
Fall, 3(3-0) Interdepartmental with Agricultural Engineering, Civil Engineering, and Mechanical Engineering.
R: Approval of department.
Theory and application of the finite element method to the solution of continuum type problems in heat transfer, fluid mechanics, and stress analysis.
QA: MMM 809
- 810. Continuum Mechanics**
Fall, 3(3-0)
P: MSM 401, MTH 424.
Mathematical tools of continuum mechanics, stress principles, kinematics of deformation and motion, fundamental laws and equations. Applications in linear elasticity and classical fluids.
QP: MMM 401, MTH 421 QA: MMM 810
- 813. Linear Elasticity**
Spring, 3(3-0)
P: MSM 810.
Fundamentals of isotropic linear elasticity. Solution of plane elasticity problems. St. Venant bending and torsion. Singular solutions. Basic three-dimensional solutions.
QP: MMM 810 QA: MMM 813
- 814. Mechanics of Composite Materials (MTC)**
Fall, 3(3-0) A student may earn a maximum of 6 credits in all enrollments for this course.
Topics vary each semester. Topics such as fiber-reinforced composite materials or laminated composite structures.
QP: MMM 813 QA: MMM 814
- 815. Advanced Strength of Materials**
Spring of even-numbered years. 3(3-0)
P: MSM 401.
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.
QP: MMM 401 QA: MMM 815
- 816. Fracture Mechanics and Fatigue**
Spring of odd-numbered years. 3(3-0)
P: 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.
QP: MMM 813 QA: MMM 916, MMM 917
- 817. Plasticity**
Spring of even-numbered years. 3(3-0)
P: MSM 813.
Yield conditions, stress-strain relations, plastic potential, hardening theories, torsion, bending. Thick walled shells under internal pressure. Limit analysis. Slip line theory.
QP: MMM 813 QA: MMM 817
- 820. Energy Methods in Mechanics**
Spring of odd-numbered years. 3(3-0)
P: MSM 813.
Calculus of variations. Variational principles in mechanics. Approximate methods. Energy criteria for stability. Applications to structural dynamics.
QP: MMM 813 QA: MMM 820
- 835. Wave Propagation in Solids**
Fall of odd-numbered years. 3(3-0)
P: MSM 810.
Plane waves in elastic media, reflection of waves at interfaces. Surface waves, waveguides. Application to nondestructive evaluation. Introduction to wave propagation in anisotropic and nonelastic solids.
QP: MMM 810
- 840. Plates and Shells**
Fall of odd-numbered years. 3(3-0) Interdepartmental with Civil Engineering.
P: MSM 815.
Deformation and stress analysis of plates and shells with different types of geometry, thickness, and boundary conditions.
QP: MMM 815 QA: MMM 912, C E 909
- 851. Thermodynamics of Solids**
Fall, 3(3-0)
P: MSM 351.
Use of Jacobians. Thermodynamic functions. Thermodynamics of solid-solid phase transformation. Thermoelastic solids, rubber elasticity and stressed solid. Surfaces and interfaces, point defects in solids. Thermodynamics of solids under high pressure.
QP: MMM 330 QA: MMM 825
- 855. Advanced Rate Theory and Diffusion**
Spring, 3(3-0)
P: MSM 851.
Review of Pick's Laws. Atomistic aspects of diffusion. Defects in solids. Probabilistic basis of random walk. Green's function solutions.
QP: MMM 825 QA: MMM 863
- 862. Dislocation Theory**
Fall, 3(3-0)
P: MSM 451.
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.
QP: MMM 430 QA: MMM 872

Descriptions—Materials Science and Mechanics of Courses

- 865. Advanced Theory of Solids**
Spring, 3(3-0)
P: MSM 851.
Quantum mechanics. Free electron theory. Energy bands, semiconductors. Dielectrics and ferroelectrics. Dia-, para-, ferro-, and antiferro-magnetism. Superconductivity. Thermal properties.
QP: MMM 825 QA: MMM 861
- 870. Electron Microscopy in Materials Science**
Spring, 3(2-3)
P: MSM 451. R: Open only to majors in Materials Science.
Theory of electron diffraction. Electromagnetic lenses. Image formation in transmission electron microscopy. Defect analysis and diffraction contrast.
QP: MMM 430 QA: MMM 832
- 875. Engineering Ceramics**
Fall of odd-numbered years. 3(3-0)
P: MSM 454, MSM 455.
Physical properties of engineering ceramics. Transport properties of ceramics, especially in ferrites and garnets. Optical ceramic materials.
QP: MMM 420, MMM 454 QA: MMM 849
- 876. Advanced Polymeric Materials**
Fall of even-numbered years. 3(3-0)
P: MSM 380.
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.
QA: MMM 885
- 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.
QA: MMM 800
- 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.
QA: MMM 890
- 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.
QA: MMM 899
- 905. Optical Methods of Measurement**
Fall of even-numbered 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.
QA: MMM 806
- 909. Boundary Element Method**
Spring of even-numbered years. 3(3-0)
P: MSM 813.
Theory and application of the boundary element method to the solution of continuum type problems in heat transfer, fluid mechanics and stress analysis. Computer applications.
QP: MMM 813
- 915. Nonlinear Elasticity**
Spring of odd-numbered years. 3(3-0)
P: 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.
QP: MMM 813 QA: MMM 915

- 918. Thermoelasticity and Viscoelasticity**
Spring of odd-numbered years. 3(3-0)
P: MSM 810, MTH 443.
Thermomechanics of solids. Theory of thermoelasticity. Boundary value problems in thermoelasticity. Linear and nonlinear viscoelasticity. Model representation. Boltzmann superposition. Correspondence principle.
QP: MMM 810, MTH 422 QA: MMM 918
- 922. Micromechanics**
Spring of even-numbered years. 3(3-0)
P: MSM 813.
Models of microstructures. Inclusion problems. Eigen-strain method. Upper and lower bounds. Methods of statistical elasticity. Approximate methods. Mechanics of random networks. Percolation models of damage.
QP: MMM 813
- 960. Advanced Physical and Mechanical Properties of Materials (MTC)**
Fall, 3(3-0) A student may earn a maximum of 9 credits in all enrollments for this course. Topics vary each semester. Topics such as microcracking in brittle materials, anisotropic crystalline properties, or surfaces, interfaces and thin film structures.
- 970. Advanced Analytical Techniques (MTC)**
Spring, 3(3-0) A student may earn a maximum of 9 credits in all enrollments for this course. Topics vary each semester. Topics such as advanced techniques in electron microscopy, advanced analytical methods in materials science, or advanced X-ray methods.
- 980. Advanced Processing Techniques (MTC)**
Spring, 3(3-0) A student may earn a maximum of 9 credits in all enrollments for this course. Topics vary each semester. Topics such as ceramic processing, or high temperature deformation and processing, or laser and plasma 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.
QA: MMM 900
- 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: Open only to graduate students in Materials Science or Mechanics. 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.
QA: MMM 999

- 110. College Algebra and Finite Mathematics**
Fall, Spring, Summer. 5(5-0)
P: MTH 1825 or designated score on mathematics placement test. R: Not open to students with credit in MTH 103 or MTH 116 or MTH 120 or LBS 117. Functions and graphs. Equations and inequalities. Systems of equations. Matrices. Linear programming. Simplex algorithm. Probability.
QP: MTH 108 QA: MTH 110, MTH 108
- 116. College Algebra and Trigonometry**
Fall, Spring, Summer. 5(5-0)
P: MTH 1825 or designated score on mathematics placement test. R: Not open to students with credit in MTH 110 or MTH 113 or MTH 120 or LBS 117. Functions and graphs. Equations and inequalities. Exponential and logarithmic functions. Trigonometric functions. Systems of equations. Binomial theorem.
QP: MTH 108 QA: MTH 111, MTH 109, MTH 108
- 120. Algebra and a Survey of Calculus**
Fall, Spring, Summer. 5(5-0)
P: MTH 1825 or designated score on mathematics placement test. R: Not open to students with credit in MTH 103 or MTH 110 or MTH 116 or MTH 124 or LBS 117. Functions and graphs. Equations and inequalities. Systems of equations. Limits. Continuous functions. Derivatives. Applications of derivatives. Integrals. Fundamental theorem of calculus.
- 124. Survey of Calculus with Applications I**
Fall, Spring, Summer. 3(3-0)
P: Designated score on mathematics placement test or MTH 103. R: Not open to students with credit in MTH 120 or MTH 132 or MTH 152H or LBS 118. Study of limits, continuous functions, derivatives, integrals and their applications.
QP: MTH 108 or MTH 111
- 126. Survey of Calculus with Applications II**
Fall, Spring, Summer. 3(3-0)
P: MTH 120 or MTH 124. R: Not open to students with credit in MTH 133 or MTH 153H. Application of partial derivatives, integrals, optimization of functions of several variables and infinite series
- 132. Calculus I**
Fall, Spring, Summer. 3(3-0)
P: MTH 116 or designated score on mathematics placement test. R: Not open to students with credit in MTH 120 or MTH 124 or MTH 152H or LBS 118. Limits, continuous functions, derivatives and their applications. Integrals and the fundamental theorem of calculus.
QP: MTH 109 or MTH 111 QA: MTH 112, MTH 122
- 133. Calculus II**
Fall, Spring, Summer. 4(4-0)
P: MTH 132 or MTH 152H. R: Not open to students with credit in MTH 126 or MTH 153H. Applications of the integral and methods of integration. Improper integrals. Polar coordinates and parametric curves.
QA: MTH 113, MTH 123
- 152H. Honors Calculus I**
Fall. 3(3-0)
R: Open only to Honors College students. Not open to students with credit in MTH 120 or MTH 124 or MTH 132 or LBS 118. Limits, continuous functions, derivatives, integrals, fundamental theorem of calculus. Special emphasis on concepts and theory.
QA: MTH 112
- 153H. Honors Calculus II**
Spring. 3(3-0)
P: MTH 152H. R: Honors College student. Not open to students with credit in MTH 133 or MTH 126. The integral. Improper integrals. Polar coordinates and parametric curves. Special emphasis on concepts and theory.
QA: MTH 113

MATHEMATICS

MTH

**Department of Mathematics
College of Natural Science**

- 103. College Algebra**
Fall, Spring, Summer. 3(3-0)
P: MTH 1825 or designated score on mathematics placement test. R: Not open to students with credit in MTH 110 or MTH 116 or MTH 120 or LBS 117. Number systems; variables; functions and relations; mathematical induction; exponents and radicals; elementary theory of equations; binomial theorem; determinants, matrices, and systems of equations.
QP: MTH 082 QA: MTH 108, MTH 111