Descriptions — Marketing and Transportation Administration of Courses

910B. Advanced Research in Marketing II
Spring, 5(5-0) MTH 910A.
Continuation of MTH 910A.

911A. History of Market Thought
Fall. 4(4-0) May reenroll for a maximum of 15 credits. MTH 851.
Traces the evolution of marketing institutions, techniques, theories and criticisms. The influence of changing environmental and technological factors on marketing practice and thought. Readings in retrospective and original materials, discussion and research paper.

911B. Seminar in Macro Marketing
Winter. 4(4-0) May reenroll for a maximum of 15 credits. MTH 911A.
Examines the relationships between competition, marketing and corporate and economic growth. Emphasis is given to a functional examination of competition and the central role of innovation in the process.

912. Research Methodology in Transportation-Distribution Systems
Winter. 4(4-0) MTH 812, MTH 909. Research methodology in the design and administration of transportation/distribution systems. Emphasis on technique and methodology for conducting system design studies and evaluation of common implementation problems.

914. Transportation-Distribution Development Policy
Spring, 4(4-0) MTH 909, MTH 912. Applications in theory, principles, and process developed in MTH 909 and MTH 912 to the design of research processes and reports in significant transport and distribution problems.

957. Seminar in Micro Marketing
Spring, 4(4-0) MTH 911A. Examines the current state of theory concerning the planning and implementation of marketing strategies and programs, and tries to identify where future research is needed and/or will be most useful to marketing and business managers.

999. Doctoral Dissertation Research
Fall, Winter, Spring, Summer. Variable credit. Approval of department.

MATHMATICS MTH

College of Natural Science
One and one-half years of high school algebra and one year of geometry and a satisfactory score on the placement test are prerequisites for all courses in the Department of Mathematics which carry credit.

0523. Intermediate Algebra
Fall, Winter, Spring, Summer. 0(2-0) 3(3-0) See page A-1 item 3. Current enrollment in MTH 1043, one year of high school algebra, satisfactory score on placement exam.
Properties of real numbers, polynomials, factoring, exponents, roots and radicals, whole numbers, word problems, system of equations, operations on algebraic expressions, simplifying algebraic expressions.
Approved through Summer 1986.

1033. Elements of Algebra
Fall, Winter, Spring, Summer. 2(2-0) Current enrollment in MTH 1083, one year of high school algebra, satisfactory score on placement exam.
Fractions, decimals, real number properties, algorithms of arithmetic, simplifying algebraic expressions, parentheses, reciprocals, linear equations, integer exponents, applied problems, coordinate systems, graphing, solving equations by graphing.
Approved through Summer 1986.

1043. Intermediate Algebra
Fall, Winter, Spring, Summer. 3(3-0) Current enrollment in MTH 1023, one year of high school algebra, satisfactory score on placement exam.
Properties of real numbers, polynomials, factoring, exponents, roots and radicals, first and second degree equations, linear inequalities, complex numbers, word problems, system of equations, operations on algebraic expressions, simplifying algebraic expressions.
Approved through Summer 1986.

1053. College Algebra and Trigonometry I
Fall, Winter, Spring, Summer. 5(5-0) 1-1/2 high school units in algebra and satisfactory score on placement test, or MTH 1023, 1 high school unit in geometry. Not open to students with credit in MTH 111.
Number systems; variables; functions and relations; mathematical induction; exponents and radicals; elementary theory of equations; binomial theorem; determinants, matrices and systems of equations.

109. College Algebra and Trigonometry II
Fall, Winter, Spring, Summer. 5(5-0) MTH 106; not open to students with credit in MTH 111.
Continuation of MTH 108 plus trigonometry including definition of circular functions, angular measure, fundamental identities.

110. Finite Mathematics with Applications
Fall, Winter, Spring, Summer. 5(5-0) MTH 106 or MTH 111.
Elementary combinatorial analysis, binomial theorem, vectors and matrices, convex sets and linear programming, graph theory, applications to theory of games.

111. College Algebra with Trigonometry
Fall, Winter, Spring, Summer. 5(5-0) 1-1/2 years of high school algebra, 1 year of high school geometry, satisfactory score on algebra placement examination, trigonometry or MTH 102 or concurrently. Not open to students with credit in MTH 108 or MTH 109.
Sets and equations, simultaneous equations and matrices, vectors, inequalities, functions and relations, inverse functions, elementary theory of equations, trigonometric equations and identities, polar coordinates, parametric equations, straight line analytic geometry.

112. Calculus and Analytic Geometry I
Fall, Winter, Spring, Summer. 5(5-0) MTH 109 or MTH 111.
The sequence MTH 112, MTH 113, MTH 214, MTH 215, is an integrated course in calculus and analytic geometry, covering derivatives, curve sketching, definite and indefinite integrals, area, volume, transcendental functions, vector analysis, solid geometry, partial differentiation, multiple integrals, infinite series, power series.

113. Calculus and Analytic Geometry II
Fall, Winter, Spring, Summer. 5(5-0) MTH 112.
A continuation of MTH 112.

122. Calculus I
Fall, Winter, Spring, 5(5-0) MTH 122 or MTH 111; not open to engineers, physical science or mathematics majors or to students with credit in MTH 112.
The first of a two-term course in primarily single variable calculus with and introduction to several variables for students who want only one or two terms of calculus.

190. Freshman Mathematics Seminar
Fall, Winter, Spring, 3(3-0) 3. Freshmen Mathematics majors; prior or concurrent calculus enrollment.
Intended to introduce mathematics majors to the type of mathematical reasoning and subject matter they can expect to encounter in advanced mathematics courses. Specific content will vary.

201. Mathematical Foundations for Elementary School Teachers
Fall, Winter, Spring, 4(4-0) 1-1/2 high school units in algebra and satisfactory score on placement test, or MTH 1023, 1-1/2 high school units in geometry. Open only to elementary education majors.
Fundamental concepts and processes of mathematics for prospective elementary school teachers.

204. Applied Mathematics in Elementary School
Fall, Winter, Spring, 4(4-0) MTH 201, elementary education majors.
Concepts and applications of algebra and geometry for prospective elementary teachers.

214. Calculus and Analytic Geometry III
Fall, Winter, Spring, Summer. 4(4-0) MTH 113.
Continuation of MTH 113.

215. Calculus and Analytic Geometry IV
Fall, Winter, Spring, Summer. 4(4-0) MTH 214.
Continuation of MTH 214.

216. Mathematics of Finance
Winter. 3(3-0) MTH 108 or MTH 111.
Mathematical theory of interest with application to such topics as ordinary due, and deferred annuities, amortization of debts, depreciation, capitalized cost, purchase price of bonds.
290. Special Topics in Mathematics
Fall, Winter, Spring. 1 to 5 credits. May reenroll for a maximum of 9 credits. Approval of department.

Individualized study adapted to the preparation and interests of the student. Topics studied will generally supplement and enrich the regular course.

302. Introduction to Combinatorics and Its Applications
Spring. 4(4-0) MTH 113.

Permutations, combinations, the binomial and multinomial theorems, the principle of inclusion and exclusion, derangements, recurrence relations, Fibonacci sequences, generating functions, trees, graphs, chromatic polynomials, paths in networks.

309. Theory of Equations
Winter. 4(4-0) MTH 113 or approval of department.

Desirable for those preparing to teach mathematics in high schools. Mathematical induction, complex numbers, theorems in roots of polynomial equations, cyclotomic equations, ruler and compass constructions, solution of cubic and quartic equations, approximation to roots, theory of determinants, an introduction to matrices and some history of the theory of equations.

310. Differential Equations
Fall, Winter, Spring, Summer. 3(3-0) MTH 215 or concurrently.

First and second order equations; solutions in series, higher order equations, systems of differential equations, applications.

315. Concepts of Geometry I
Fall, Winter, Spring. 3(3-0) MTH 214 or approval of department.

Axiomatic structure of geometries including Euclidean, the classical non-Euclidean and projective geometries. Coordinate systems and geometric transformations.

316. Concepts of Geometry II
Winter. 3(3-0) MTH 315.

Continuation of MTH 315.

324. Foundations of Analysis
Fall, Winter, Spring. 4(4-0) MTH 215.

Elementary set theory; functions, mappings, equivalence relations; sequences and series; Cauchy sequences; least upper bound; continuity; connected and compact sets: Bolzano-Weierstrass Theorem; continuity.

331. Theory of Numbers
Fall, Winter, Spring. 3(3-0) MTH 113 or approval of department.

Diophantine equations, congruences, quadratic residues, finite fields.

334. Theory of Matrices
Fall, Winter, Spring. Summer. 4(4-0) MTH 214 or approval of department.

Algebra of matrices, vector spaces, rank, inverses, determinants, systems of equations, quadratic forms, Hermitian matrices, similarity transformations, characteristic values, linear transformations.

337. Concepts of Algebra
Winter. 3(3-0) MTH 214 or approval of department.

Rings, integral domains, properties of integers, fields, groups, polynomials.

341. Initial and Boundary Value Problems
Winter, Spring. 4(4-0) MTH 310.

Introduction to partial differential equations and initial and boundary value problems; emphasis on the wave equation, Laplace equation and heat flow equations and their solutions by separation of variables.

351. Introduction to Numerical Analysis
Winter, Spring. 4(4-0) MTH 310 and knowledge of FORTRAN programming; students may not receive credit in both MTH 351 and MTH 421.

Introduction to numerical analysis; computer coding using a compiler language; approximation to roots of equations, interpolation, numerical quadrature, numerical solution of ordinary differential equations.

352. Introduction to Numerical Solutions of Partial Differential Equations
Fall. 4(4-0) MTH 351.

Numerical solutions of boundary value problems, both two point and in the plane, iterative methods for matrix equations. Introduction to stability and error analysis.

381. Chemical Engineering Analysis
Fall, Spring. 3(3-0) Students may not receive credit in both CHE 381 and MTH 341. MTH 310. Interdepartmental with and administered by the Department of Chemical Engineering.

Formulation of ordinary and partial differential equations describing chemical systems. Boundary value problems, numerical methods, matrices and applications, to chemical engineering systems.

400H. Honors Work
Fall, Winter, Spring. 1 to 18 credits. MTH 215 or approval of department.

Individualized reading and study in mathematics for students of high intellectual promise.

401. Geometry for Teachers
Summer. 3(3-0) Approval of department; not applicable to major or minor requirements.

Topics in geometry for junior and senior high school teachers.

405. Mathematical Topics for Teachers
Fall, Winter, Spring. 3(3-0) May reenroll for a maximum of 12 credits. Approval of department; open only to teachers participating in teacher institutes or special extension courses.

406. Mathematical Modeling for Teachers
(350.) Spring. 3(3-0) MTH 215.

Mathematical topics covered include: binary, octal and hexadecimal arithmetic, Euclidean algorithm and prime number generators, root finding for polynomials, approximation of functions, difference equations, combinatorics and probability problems, topics from geometry, and mathematical modeling and simulation.

414. Differential and Analytic Geometry
Spring. 4(4-0) MTH 215 or approval of department.


420. Ordinary Differential Equations
Spring. 4(4-0) MTH 310, MTH 334.

Existence and uniqueness theorems, linear systems, plane autonomous systems, introduction to stability theory, Lyapunov's second method, applications.

421. Vector and Tensor Analysis
Fall, Winter, Summer. 4(4-0) MTH 310, MTH 334 recommended.

Vector calculus, line and surface integrals, divergence and Stokes theorem, orthogonal coordinate systems, introduction to tensors; applications to the physical sciences.

422. Boundary Value Problems and Fourier Series
Fall, Winter, Spring. 4(4-0) MTH 310, MTH 424.


423. Complex Variables
Winter. 4(4-0) MTH 310 or approval of department.

Analytic functions, integrals, power series, residues, poles, conformal mapping and applications.

424. Advanced Calculus
Fall, Winter, Spring. 4(4-0) MTH 215.

Limits and continuity, function of several variables, ordinary and partial derivatives, theory of integration, multiple, line and surface integrals, infinite series, improper integrals, Beta and Gamma functions and other topics.

425. Advanced Calculus
Winter. 3(3-0) MTH 334.

Continuation of MTH 424.

426. Advanced Calculus
Winter, Spring. 2(2-0) MTH 425.

Continuation of MTH 425.

427. Real Analysis I
Fall. 4(4-0) Approval of department.

Topology, limits and continuity in En, functions of bounded variation, Riemann integration, calculus of several variables, linear transformations and derivatives.

428. Real Analysis II
Winter. 4(4-0) MTH 427.

Continuation of MTH 427.

429. Real Analysis III
Spring. 4(4-0) MTH 428.

Continuation of MTH 428.

430. Introduction to Error-Correcting Codes
Winter. 3(3-0) MTH 334.

Block codes and maximum likelihood decoding; Galois fields; encoding and decoding linear codes, cyclic codes (using shift registers), burst-error-correcting codes, convolutional codes.

432. Abstract Algebra I
Fall, Winter. 4(4-0) MTH 215.

Introduction to the concepts of basic algebraic structures, namely: group, ring, integral domain, field polynomial ring, module, vector space, linear transformation, etc.
Descriptions — Mathematics of Courses

433. Abstract Algebra II
Winter, Spring. 4(4-0) MTH 432.
Continuation of MTH 432.

434. Abstract Algebra III
Spring. 4(4-0) MTH 433.
Continuation of MTH 433.

437. Theory of Numbers II
Spring. 3(3-0) MTH 331 or MTH 432 or approval of department.

439. Mathematical Analysis II
Fall, Winter, Spring. 4(4-0) MTH 214 or MTH 123.

450. Numerical Analysis I
Winter. 4(4-0) MTH 424 or concurrently, MTH 334, knowledge of FORTRAN programming.

451. Numerical Analysis II
Spring. 4(4-0) MTH 451.
Continuation of MTH 451.

461. Topology
Winter. 3(3-0) MTH 424.
Introduction to fundamental concepts in topology, to metric and topological spaces, connectedness, compactness, continuity and simple connectedness.

462. Combinatorial Topology
Spring. 3(3-0) MTH 461 or MTH 424.
Universal graphs, surface topology, classification of surfaces, elementary set-theoretic topology, complexes.

471. Mathematical Logic
Fall. 4(4-0) MTH 215 or approval of department.

480. Mathematics for Economists
Fall. 5(5-0) MTH 113, graduate status in either economics, agricultural economics or College of Business Administration, or approval of department.

481. Selected Mathematical Ideas in Biology
Winter, Spring. 4(4-0) MTH 214 or MTH 123.

490. Mathematical Problems
Fall, Winter, Spring. 4(4-0) MTH 214 or MTH 123.

492. Advanced Topics in Mathematics
Fall, Winter, Spring. 3 to 6 credits. May enroll for up to 12 credits. Approval of department.

501. Mathematics Education I
Fall. 3(3-0) Graduate student in mathematics or approval of department.

502. Mathematics Education II
Winter. 3(3-0) Graduate student in mathematics or approval of department.

503. Mathematics Education III
Spring. 3(3-0) Graduate student in mathematics or approval of department.

504. Linear Algebra and Analysis I
Spring. 3(3-0) MTH 334, MTH 424.
Linear and matrix algebra, Graussman algebra, differential and integral calculus in Rn, linear differential equations, differential forms, closed and exact forms, Stokes theorem and elements of differential manifolds.

505. Linear Algebra and Analysis II
Winter. 3(3-0) MTH 804.
Continuation of MTH 804.

506. Linear Algebra and Analysis III
Spring. 3(3-0) MTH 805.
Continuation of MTH 805.

511. Theory of Relativity
Winter of even-numbered years. 4(4-0) MTH 810.
Physical bases of theory of relativity. Introduction to space-time of two and four dimensions, and to relativistic dynamics, hydrodynamics and electromagnetism. Relativistic effects in solar gravitation field.

514. Introduction to Differential Geometry
Spring. 4(4-0) MTH 426 or approval of department.
Curves and surfaces in 3-space, curvature, torsion, Frenet formulas, Riemannian manifolds, Gauss and mean curvature, geodesics, theorem of Gauss-Bonnet and Hilbert theorems.

517. Theory of Linear Graphs I
Winter. 3(3-0) MTH 334, MTH 424, or concurrently, MTH 334, knowledge of abstract algebra.

518. Theory of Linear Graphs II
Spring. 3(3-0) MTH 426 or concurrently, MTH 334, knowledge of abstract algebra.

519. Theory of Linear Graphs III
Spring. 3(3-0) MTH 426 or concurrently, MTH 334, knowledge of abstract algebra.

804. Complex Analysis
Fall. 3(3-0) MTH 804.

805. Theory of Linear Graphs II
Spring. 3(3-0) MTH 805.

806. Theory of Linear Graphs III
Spring. 3(3-0) MTH 806.

807. Introduction to Differential Geometry
Spring. 4(4-0) MTH 426 or approval of department.
Differential geometry in manifolds, vector fields, Frobenius theorem, tensor algebra, differential forms, affine connections, Riemannian metrics, curvature, geodesics, parallel transport, Jacobi fields, conjugate and cut loci, topological implications of curvature.

814A. Differential Geometry I
Fall. 3(3-0) MTH 814A.

814B. Differential Geometry II
Fall. 3(3-0) MTH 814B.
Additional topics on submanifold theory, symplectic and contact manifolds and Dolbeault cohomology.

816. Tensor Calculus and Riemannian Geometry
Fall of odd-numbered years. 4(4-0) MTH 426.
Contravariant and covariant tensors, metric tensors, geodesics, Christoffel symbols, covariant differentiation, curvature, Ricci tensor, parallel propagation, relative tensors, extension, spaces with affine connection, Weyl spaces, applications to dynamics, hydrodynamics and electromagnetic radiation.

817. Theory of Linear Graphs I
Winter. 3(3-0) MTH 334, MTH 424, or approval of department.

821. Topology and Analysis I
Fall. 3(3-0) MTH 214 or MTH 804 concurrently, or approval of department.

822. Topology and Analysis II
Winter. 3(3-0) MTH 821.
Continuation of MTH 821.

823. Topology and Analysis III
Spring. 3(3-0) MTH 822.
Continuation of MTH 822.
843. Boundary Value Problems
Fall, 3(3-0) MTH 843.

844. Methods of Applied Analysis I
Fall, 3(3-0) MTH 823.

845. Methods of Applied Analysis II
Winter, 3(3-0) MTH 844.

846. Methods of Applied Analysis III
Spring, 3(3-0) MTH 845.

847. Theory of Ordinary Differential Equations I
Fall, 3(3-0) MTH 426; matrix theory.

848. Theory of Ordinary Differential Equations II
Winter, 3(3-0) MTH 447.

849. Theory of Ordinary Differential Equations III
Spring, 3(3-0) MTH 848; approval of department.

850. Numerical Solutions of Ordinary Differential Equations
Fall, 3(3-0) MTH 851 or approval of department.

851. Numerical Analysis I
Fall, 3(3-0) MTH 426; FORTRAN programming and matrix theory recommended.

852. Numerical Analysis II
Winter, 3(3-0) MTH 852.

853. Numerical Analysis III
Spring, 3(3-0) MTH 853.

Fall, 3(3-0) MTH 804 or concurrently.

855. Mathematics of Operations Research II
Winter, 3(3-0) MTH 854, MTH 805 or concurrently.

856. Mathematics of Operations Research III
Spring, 3(3-0) MTH 806 or concurrently.

Spring, 4(4-0) MTH 422, knowledge of matrices recommended. Knowledge of computer programming desirable.

858. Numerical Solutions of Partial Differential Equations
Spring, 3(3-0) MTH 858.

859. General Topology I
Fall, 3(3-0) Approval of department.

860. General Topology II
Winter, 3(3-0) MTH 861.

861. General Topology III
Spring, 3(3-0) MTH 862.

862. Differential Topology
Spring, 3(3-0) MTH 456, MTH 862.

863. Foundations of Mathematics I
Fall of even-numbered years, 3(3-0) MTH 424; MTH 471 recommended.

864. Foundations of Mathematics II
Spring, 3(3-0) MTH 425, MTH 472 recommended.

865. Foundations of Mathematics III
Fall of odd-numbered years, 3(3-0) MTH 426, MTH 863.

866. Advanced Topology
Spring, 3(3-0) MTH 456, MTH 862.

571. Foundations of Mathematics II
Winter of odd-numbered years. 3(3-0)
MTH 871.
Continuation of MTH 571.

572. Foundations of Mathematics III
Spring of odd-numbered years. 3(3-0)
MTH 872.
Continuation of MTH 571.

578. Functions of a Complex Variable
Fall of odd-numbered years. 3(3-0)
MTH 878.
Continuation of MTH 571.

581. Functional Analysis
Fall, 3(3-0) MTH 426 or MTH 423.
Introduction to the mathematical theory of clas­
sical applied mathematics; properties and postu­lates of various theories such as ideal fluids and
linear elasticity; derivation of field equations;
formulation of initial and boundary value prob­lems.

584. Fluid Dynamics II
Fall of odd-numbered years. 3(3-0)
MTH 884.
Continuation of MTH 584.

586. Partial Differential Equations I
Fall, 3(3-0) MTH 334, MTH 423.
Cauchy-Kowalewski theorem; classification,
characteristics, normal forms; general theory of
first order equations; potential theory.

587. Partial Differential Equations II
Winter of odd-numbered years. 3(3-0)
MTH 887.
Elliptic type equations; Green’s Neumann’s and
Kernel functions; boundary value problems and
integral equations; hyperbolic equations; geometry
of characteristics, Riemann’s functions.

590. Reading in Mathematics
Fall, Winter, Spring, Summer. 1 to 6
credits. May reenroll for a maximum of 26 cred­
ts. Approval of department.

599. Master’s Thesis Research
Fall, Winter, Spring, Summer. Varia­ble credit. Approval of department.

920. Harmonic Analysis I
Fall of odd-numbered years. 3(3-0)
MTH 920, MTH 922 or approval of department.
Fourier series, mean and point-wise conver­gence. Fourier-Stieltjes series. Maximal func­
tions and a.e. convergence. Conjugate

924. Functional Analysis I
Fall of odd-numbered years. 3(3-0)
MTH 924 or approval of department.
Topological groups and topological vector
spaces; metrizability, locally convex spaces; Hahn-Banach and Krein-Milman theorems,
dual spaces, Banach spaces, Hilbert spaces,
Banach algebras.

925. Functional Analysis II
Winter of even-numbered years. 3(3-0)
MTH 925 or approval of department.
Continuation of MTH 924.

926. Functional Analysis III
Spring of even-numbered years. 3(3-0)
MTH 926.
Continuation of MTH 925.

927. Harmonic Analysis II
Winter of odd-numbered years. 3(3-0)
MTH 927.
Fourier transforms on $\mathbb{R}$ and $\mathbb{R}^n$.
Tempered distributions, inversion formula, Plancherel Theo­
rem, pseudo-measures, almost-periodic
functions, spectral properties, Wiener Tauber­
ian theorem, Paley-Wiener Theorems.

929. Harmonic Analysis III
Spring of odd-numbered years. 3(3-0)
MTH 929.
Selected topics from Fourier analysis on compact
groups, singular integrals, harmonic analysis in
$\mathbb{R}$, Hp theory in one and several variables or
differentiation of integrals.

934. Advanced Group Theory I
Fall, 3(3-0) MTH 934.
Permutation groups, characters, $\pi$-properties
automorphisms, lattices of subgroups, classes of
infinite groups, linear groups, recent literature.

935. Advanced Group Theory II
Winter, 3(3-0) MTH 935.
Continuation of MTH 934.

936. Advanced Group Theory III
Spring, 3(3-0) MTH 936.
Continuation of MTH 935.

948. Fluid Dynamics III
Spring of odd-numbered years. 3(3-0)
MTH 948.
General theory of perfect fluids including motion
of incompressible fluids in two and three
dimensions and applications to problems of wing
profiles. Viscous and compressible fluids dis­
cussed briefly.

951. Approximation Theory I
Fall of odd-numbered years. 3(3-0)
MTH 951 or approval of department.
Tchebycheff, approximation with polynomials,
rational functions and general linear families;
the Unicity problem; degree of approximation;
Berstein Polynomials; Renes algorithm, uniform
approximation with constraints.

952. Approximation Theory II
Winter of even-numbered years. 3(3-0)
MTH 952.
Continuation of MTH 951. Generalized meth­ods
of measuring error: Approximation in Li1
and Lp norms, least-square approximation and
orthogonal functions; spline functions; approxi­mation in normed linear spaces.

953. Approximation Theory III
Spring of even-numbered years. 3(3-0)
MTH 953.
Continuation of MTH 952.

954. Algebraic Topology I
Fall, 3(3-0) MTH 954, MTH 956.
Simplicial and singular homotopy theory, Eilen­
berg-Steenrod axioms, chain complexes, cell
complexes, applications to Euclidean spaces.

955. Algebraic Topology II
Winter, 3(3-0) MTH 955.
Continuation of MTH 954 including category and fonctor theory, general coefficient and co­homology theory.

956. Algebraic Topology III
Spring, 3(3-0) MTH 956.
Continuation of MTH 955 including homology
groups of products, Eilenberg-Zilber theorems,
cohomology products, differential topology.

991. Advanced Topics in Geometry
Fall, Winter, Spring, Summer. 1 to 6
credits. May reenroll for a maximum of 36 cred­its. Approval of department.

992. Advanced Topics in Analysis
Fall, Winter, Spring, Summer. 1 to 6
credits. May reenroll for a maximum of 36 cred­its. Approval of department.
Advanced topics in analysis.

993. Advanced Topics in Algebra
Fall, Winter, Spring, Summer. 1 to 6
credits. May reenroll for a maximum of 36 cred­its. Approval of department.
Structure of rings and algebras, Lie Algebras,
Jordan algebras, advanced algebraic number
theory, advanced matrix theory, and advanced
topics in group theory, Lattice theory.

994. Advanced Topics in Applied Mathematics
Fall, Winter, Spring, Summer. 1 to 6
credits. May reenroll for a maximum of 36 cred­its. Approval of department.
Nonlinear differential equations, asymptotic

999. Doctoral Dissertation Research
Fall, Winter, Spring, Summer. Varia­ble credit. Approval of department.

MECHANICAL
ENGINEERING

College of Engineering

201. The Science of Sound I: Rock, Bach
and Oscillators (N)
Winter, 4(4-0) Interdepartmental with
and administered by Physics.
Production, propagation, detection of sounds.
Voice, hearing, scales, timbres, musical instru­ments. Room acoustics. Electronic reproduction
and synthesis of music. Demonstrations empha­
sized.