

**4875. Customer Relationship Management.** 3 hours. Exploration of the principles, practices, tools and technologies that underlie customer relationship management (CRM). Includes modules on building and sustaining long-term customer relationships, and using data mining and warehousing techniques to service these relationships. Also focuses on establishing CRM metrics and employing data analysis of CRM outcomes. Students are required to develop a CRM strategic plan for a market offering. Prerequisite(s): MKTG 3650 (non-business majors may take MKTG 2650) or consent of department.

**4880. Advanced Marketing Management.** 3 hours. Application of concepts, tools and procedures employed by practicing marketing managers. Specific attention is given to product development and management, promotion development and management, channel selection and management, physical distribution management and price setting and management. Students acquire skills in the essentials of case analysis and written as well as oral presentation of their analysis. Oral presentations may be made using electronic media. Groups may be required for case work. Prerequisite(s): MKTG 3700 and MKTG 3710.

**4890. Applied Marketing Problems.** 3 hours. Capstone marketing course. Students work in team settings to develop a comprehensive marketing plan. The marketing plan requires students to integrate a wide range of marketing principles and practices. The integrated marketing plan requires students to identify market opportunities and challenges, formulate actionable plans to address organizational strengths and weaknesses, and execute a marketing mix strategy. Requires both oral and written presentation of the marketing plan. Prerequisite(s): MKTG 4880 and graduating senior status.

**4900. Special Problems.** 1-3 hours each.

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## Master's Engineering Technology

see *Graduate Catalog*

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## Materials Science and Engineering

### **Materials Science, MTSC**

**2900-2910. Introduction to Materials Science Research.** 1-3 hours. Individualized laboratory instruction. Students may begin training on laboratory research techniques.

**4500. Internship in Materials Science.** 3 hours. A supervised industrial internship requiring a minimum of 150 hours of work experience. Prerequisite(s): consent of department.

**4900-4910. Materials Science Research.** 1-3 hours. Introduction to research; may consist of an experimental, theoretical or review topic.

**4920. Cooperative Education in Materials Science.** 3 hours. Supervised work in a job directly related to the student's major, professional field of study or career objectives. Prerequisite(s): 12 hours of credit in materials science; student must meet employer's requirements and have consent of department. May be repeated for credit.

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## Mathematics

### **Mathematics, MATH**

Students taking mathematics courses at the 2000 level or above are expected to be competent in computer programming using such languages as BASIC, C, FORTRAN or PASCAL. This competency can be obtained through completion of CSCE 1020.

For all mathematics courses, a grade of C or better is strongly recommended before progressing to the next course.

**1010. Fundamentals of Algebra.** 3 hours. Basic algebraic operations, linear equations and inequalities, polynomials, rational expressions, factoring, exponents and radicals, and quadratic equations. Prerequisite(s): consent of department. Students may not enroll in this course if they have credit for any other UNT mathematics course. Credit in this course does not fulfill any degree requirement. Pass/no pass only.

**1100 (MATH 1314 or 1414). College Algebra.** 3 hours. Quadratic equations; systems involving quadratics; variation, ratio and proportion; progressions; the binomial theorem; inequalities; complex numbers; theory of equations; determinants; partial fractions; exponentials and logarithms. Prerequisite(s): two years of high school algebra and one year of geometry, and consent of department. A grade C or better in MATH 1100 is required when MATH 1100 is a prerequisite for other mathematics courses. *Satisfies the Mathematics requirement of the University Core Curriculum.*

**1190 (MATH 1325 or 1425). Business Calculus.** 3 hours. Differential and integral calculus with emphasis on applications to business. Prerequisite(s): MATH 1100 with grade of C or better. *Satisfies the Mathematics requirement of the University Core Curriculum.*

**1350. Mathematics for Elementary Education Majors I.** 3 hours. Concepts of sets, functions, numeration systems, different number bases, number theory, and properties of the natural numbers, integers, rational, and real number systems with an emphasis on problem solving and critical thinking. Only for students requiring course for teacher certification. Prerequisite(s): MATH 1100 with a grade of C or better. *Satisfies the Mathematics requirement of the University Core Curriculum.*

**1351. Mathematics for Elementary Education Majors II.** 3 hours. Concepts of geometry, probability and statistics, as well as applications of the algebraic properties of real numbers to concepts of measurement with an emphasis on problem solving and critical thinking. Only for students requiring course for teacher certification. Prerequisite(s): MATH 1350. *Satisfies the Mathematics requirement of the University Core Curriculum.*

**1400. College Math with Calculus.** 3 hours. An applied mathematics course designed for non-science majors. All topics are motivated by real world applications. Equations, graphs, functions; exponentials and logarithms; mathematics of finance; systems of linear equations and inequalities, linear programming; probability; basic differential calculus with applications. Prerequisite(s): two years of high school algebra and consent of department; or MATH 1100 with grade of C or better. *Satisfies the Mathematics requirement of the University Core Curriculum.*

**1650 (MATH 2312 or 2412) Pre-Calculus.** 5 hours. A preparatory course for calculus. Trigonometric functions, their graphs and applications; the conic sections, exponential and logarithmic functions and their graphs; graphs for polynomial and rational functions; general discussion of functions and their properties. Prerequisite(s): MATH 1100 with grade of C or better. *Satisfies the Mathematics requirement of the University Core Curriculum.*

**1680 (MATH 1342 or 1442). Elementary Probability and Statistics.** 3 hours. An introductory course to serve students of any field who want to apply statistical inference. Descriptive statistics, elementary probability, estimation, hypothesis testing and small samples. Prerequisite(s): MATH 1100 with grade of C or better. *Satisfies the Mathematics requirement of the University Core Curriculum.*

**1710 (MATH 2313 or 2413). Calculus I.** 4 hours. Limits and continuity, derivatives and integrals; differentiation and integration of polynomial, rational and algebraic functions; applications, including slope, velocity, extrema, area, volume and work. Prerequisite(s): MATH 1650. *Satisfies the Mathematics requirement of the University Core Curriculum.*

**1720 (MATH 2314 or 2414). Calculus II.** 3 hours. Differentiation and integration of trigonometric, exponential, logarithmic and transcendental functions; integration techniques; indeterminate forms; improper integrals; area and arc length in polar coordinates; infinite series; power series; Taylor's theorem. Prerequisite(s): MATH 1710. *Satisfies the Mathematics requirement of the University Core Curriculum.*

**1780. Probability Models.** 3 hours. Probability theory, discrete and continuous random variables, Markov chains, limit theorems, stochastic processes, models for phenomena with statistical regularity. Prerequisite(s): MATH 1710.

**2510. Real Analysis I.** 3 hours. Introduction to mathematical proofs through real analysis. Topics include sets, relations, types of proofs, continuity and topology of the real line. Prerequisite(s): MATH 1720.

**2520. Real Analysis II.** 3 hours. Continuation of 2510. Topics include derivatives, integrals, limits of sequences of functions, Fourier series; and an introduction to multivariable analysis. Prerequisite(s): MATH 2510 and 2700 (may be taken concurrently).

**2700 (MATH 2318 or 2418). Linear Algebra and Vector Geometry.** 3 hours. Vector spaces over the real number field; applications to systems of linear equations and analytic geometry in  $E_n$ , linear transformations, matrices, determinants and eigenvalues. Prerequisite(s): MATH 1720.

**2730 (MATH 2315 or 2415). Multivariable Calculus.** 3 hours. Vectors and analytic geometry in 3-space; partial and directional derivatives; extrema; double and triple integrals and applications; cylindrical and spherical coordinates. Prerequisite(s): MATH 1720.

**2770 (MATH 2305 or 2405). Discrete Mathematical Structures.** 3 hours. Introductory mathematical logic, mathematical induction, relations and functions, combinatorics, counting techniques, graphs and trees, and finite automata theory. Prerequisite(s): MATH 1710 and CSCI 1110 (may be taken concurrently).

**2900-2910. Special Problems.** 1-3 hours each. May be repeated for credit.

**3010. Seminar in Problem-Solving Techniques.** 1 hour. Problem-solving techniques involving binomial coefficients, elementary number theory, Euclidean geometry, properties of polynomials and calculus. May be repeated for credit.

**3130. Mathematical Proofs.** 3 hours. Axioms of the real numbers; proofs of the basic facts of arithmetic. Careful logical reasoning is emphasized. Prerequisite(s): MATH 1350 and 1650.

**3140. Topics for Basic Mathematics.** 3 hours. For prospective or in-service teachers; fundamental contemporary mathematical concepts. Prerequisite(s): MATH 1350.

**3150. Topics in Geometry.** 3 hours. For prospective or in-service elementary school teachers; fundamental contemporary concepts in geometry. Prerequisite(s): MATH 1350.

**3310. Differential Equations with Applications.** 3 hours. First order linear equations, separable equations, second order linear equations, method of undetermined coefficients, variation of parameters, regular singular points, Laplace transforms,  $2 \times 2$  and  $3 \times 3$  first order linear systems, phase plane analysis, introduction to numerical methods and various applications. Topics include motion problems, electric circuits, growth and decay problems, harmonic oscillators, simple pendulums, mechanical vibrations, Newton's law of gravity and predator-prey problems. Recommended for engineering technology majors. May not use both 3310 and 3410 to satisfy a requirement of differential equations. Prerequisite(s): MATH 1720.

**3350. Introduction to Numerical Analysis.** 3 hours. Description and mathematical analysis of methods used for solving problems of a mathematical nature on the computer. Roots of equations, systems of linear equations, polynomial interpolation and approximation, least-squares approximation, numerical solution of ordinary differential equations. Prerequisite(s): MATH 2700 and computer programming ability.

**3400. Number Theory.** 3 hours. Factorizations, congruencies, quadratic reciprocity, finite fields, quadratic forms, diophantine equations. Prerequisite(s): MATH 3510.

**3410. Differential Equations I.** 3 hours. First-order equations, existence-uniqueness theorem, linear equations, separation of variables, higher-order linear equations, systems of linear equations, series solutions and numerical solutions. Prerequisite(s): MATH 1720 and MATH 2700.

**3420. Differential Equations II.** 3 hours. Ordinary differential equations arising from partial differential equations by means of separation of variables; method of characteristics for first-order PDEs; boundary value problems for ODEs; comparative study of heat equation, wave equation and Laplace's equation by separation of variables and numerical methods; further topics in numerical solution of ODEs. Prerequisite(s): MATH 2700 and 3410.

**3510. Introduction to Abstract Algebra I.** 3 hours. Groups, rings, integral domains, polynomial rings and fields. Prerequisite(s): MATH 2520.

**3520. Abstract Algebra II.** 3 hours. Topics from coding theory, quadratic forms, Galois theory, multilinear algebra, advanced group theory, and advanced ring theory. Prerequisite(s): MATH 3510.

**3740. Vector Calculus.** 3 hours. Theory of vector-valued functions on Euclidean space. Derivative as best linear-transformation approximation to a function. Divergence, gradient, curl. Vector fields, path integrals, surface integrals. Constrained extrema and Lagrange multipliers. Implicit function theorem. Jacobian matrices. Green's, Stokes', and Gauss' (divergence) theorems in Euclidean space. Differential forms and an introduction to differential geometry. Prerequisite(s): MATH 2700 and 2730.

**4050. Advanced Study of the Secondary Mathematics Curriculum.** 3 hours. Study of mathematical topics in the secondary curriculum from an advanced viewpoint. Discussion of the relationship between the secondary and collegiate curricula. As each of the mathematical topics is studied, related issues involving cognitive development, pedagogical methods and the philosophy of teaching and learning are considered. Prerequisite(s): MATH 3510 and 4060, EDSE 3830, and acceptance into the secondary teacher education program.

**4060. Foundations of Geometry.** 3 hours. Selections from synthetic, analytic, projective, Euclidean and non-Euclidean geometry. Prerequisite(s): MATH 2520.

**4100. Fourier Analysis.** 3 hours. Comprehensive theory of Fourier transforms, Fourier series and discrete Fourier transforms, with emphasis on interconnections. The calculus of Fourier transforms. Operator algebraic formalism. Hartley transforms. FFT and other fast algorithms. High precision arithmetic. Introduction to generalized functions (tempered distributions). Applications to signal processing, probability and differential equations. Prerequisite(s): MATH 3410.

**4200. Dynamical Systems.** 3 hours. One-dimensional dynamics. Sarkovskii's theory, routes to chaos, symbolic dynamics, higher-dimensional dynamics, attractors, bifurcations, quadratic maps, Julia and Mandelbrot sets. Prerequisite(s): MATH 2520.

**4430. Introduction to Graph Theory.** 3 hours. Introduction to combinatorics through graph theory. Topics introduced include connectedness, factorization, Hamiltonian graphs, network flows, Ramsey numbers, graph coloring, automorphisms of graphs and Polyá's Enumeration Theorem. Connections with computer science are emphasized. Prerequisite(s): MATH 2510 or 2770.

**4450. Introduction to the Theory of Matrices.** 3 hours. Congruence (Hermitian); similarity; orthogonality, matrices with polynomial elements and minimal polynomials; Cayley-Hamilton theorem; bilinear and quadratic forms; eigenvalues. Prerequisite(s): MATH 2700.

**4500. Introduction to Topology.** 3 hours. Point set topology; connectedness, compactness, continuous functions and metric spaces. Prerequisite(s): MATH 2520.

**4520. Introduction to Functions of a Complex Variable.** 3 hours. Algebra of complex numbers and geometric representation; analytic functions; elementary functions and mapping; real-line integrals; complex integration; power series; residues, poles, conformal mapping and applications. Prerequisite(s): MATH 2730.

**4610. Probability.** 3 hours. Combinatorial analysis, probability, conditional probability, independence, random variables, expectation, generating functions and limit theorems. Prerequisite(s): MATH 2730.

**4650. Statistics.** 3 hours. Sampling distributions, point estimation, interval estimation, hypothesis testing, goodness of fit tests, regression and correlation, analysis of variance, and non-parametric methods. Prerequisite(s): MATH 4610.

**4900-4910. Special Problems.** 1-3 hours each.

## Merchandising and Hospitality Management

### *Merchandising and Hospitality Management, SMHM*

Courses numbered 4900-4910 are open to advanced undergraduate students who are capable of developing a problem independently. A project is chosen by the student and instructor, and developed through conferences and approved activities under the direction of the instructor, who may require a term paper. Not open to graduate students, these courses are scheduled only when other required courses are unavailable. Prerequisite: consent of instructor and approval of the dean.

**1420. Food Sanitation.** 1 hour. An introduction to food service sanitation, providing training in the regulations and procedures necessary to prevent food poisoning and food-borne diseases in a food service environment.

**1450 (HECO 1322). Principles of Nutrition.** 3 hours. An introduction to the scientific fundamentals of human nutrition as they relate to health. Prevention of illnesses such as cancer, heart disease, osteoporosis, gastrointestinal disorders and obesity is discussed. A healthful diet and lifestyle are emphasized to enhance long-term wellness. Food and nutrition controversies are critically evaluated. *Satisfies Wellness requirement of the University Core Curriculum.*

**1470. Introduction to Professional Food Preparation.** 3 hours. (2;3) A laboratory-based course designed to familiarize students with professional food preparation principles and techniques. Uniforms required. Prerequisite(s): SMHM 1420 (may be taken concurrently).

**1500. Orientation to the Hospitality Industry.** 2 hours. A course designed to survey the hotel, restaurant, club and food service industries, including history, scope, organization and career opportunities.

**1650. Apparel Evaluation.** 3 hours. (2;2) Analysis of quality issues relative to developing and producing ready-to-wear apparel. Concepts include apparel components, silhouettes, piece good selection, sizing, and costing. Includes application of software package.

**2090. Introduction to Electronic Merchandising.** 3 hours. Survey of electronic merchandising and its application to consumer products and services for business to business and business to consumer. Introduction to electronic merchandising theory, terminology, resources, industry participants and career opportunities.

**2360. Aesthetics and Environment.** 3 hours. (2;2) Introduction to elements and principles of visual merchandising, costume and furnishings from ancient cultures; aesthetic and functional consideration in material selection, and introduction of merchandising portfolio.

**2380. AutoCAD for Interiors.** 3 hours. (2;4) Application of computer-aided design, drafting and dimensioning to interior-built spaces in an AutoCAD environment. Prerequisite(s): ART 1340 and 2430.

**2400. Introduction to the Furniture Industry.** 3 hours. Overview of the furniture and home furnishings industry. Topics include product development, manufacturing, distribution and merchandising of these products. Introduction to industry terminology, resources and career opportunities.

## Mechanical Engineering Technology

see Engineering Technology