

**4600. Retailing.** 3 hours. Principles and methods; store location and layout; sales promotion; buying and pricing; personnel management; credit; stock control. Prerequisite(s): MKTG 3650 (non-business majors may complete MKTG 2650).

**4620. E-Commerce Marketing Tools and Applications.** 3 hours. Explores the evolution of the Internet and the Internet's ensuing role in marketing. Introduction to web design, web authoring and web-based marketing applications. Prerequisite(s): MKTG 3650 (non-business majors may take MKTG 2650) or consent of department.

**4630. Electronic Retailing and Promotion Strategies.** 3 hours. Addresses advanced aspects of retailing concepts in an electronic, online setting. Topics include promotional issues, privacy and security concerns, target market assessment, building a customer base, site design, order tracking and shipping. Prerequisite(s): MKTG 3650 (non-business majors may take MKTG 2650) or consent of department.

**4640. Database Marketing Fundamentals.** 3 hours. Examines theories, issues, processes and applications involved in the strategic use of marketing databases in corporate and non-corporate settings. Emphasizes the importance of acquiring, maintaining and processing market-related information. Introduces the extension of database marketing to the concept of one-to-one marketing. Discusses uses of computer hardware and software, the Internet and telecom technology in database marketing. Examines issues involved in the creation and maintenance of marketing databases as well as their varied uses. Students complete a project, learning and using many skills related to applied database marketing. Prerequisite(s): MKTG 3650 (non-business majors may take MKTG 2650) and MKTG 4620, or consent of department.

**4650. Sales Management.** 3 hours. Basics of first-level management in a sales setting. Topics include planning, organizing, staffing, directing and controlling the sales operation. Prerequisite(s): MKTG 3650 (non-business majors may complete MKTG 2650).

**4710. Advanced Marketing Research.** 3 hours. Limited to students with superior academic standing and requires the recommendation of marketing faculty. The course involves conducting a complete term/semester-long market research project with a business client. Student teams identify the client's information needs and the appropriate sources of data, design the data collection instrument, select an appropriate sample, implement the data collection process, analyze the data, write and present a "consultant's report." Makes extensive use of statistical and graphics software and packages. Prerequisite(s): MKTG 3710 and consent of department.

**4750. Marketing of Services.** 3 hours. An examination of the selection, application and monitoring of marketing services. Focuses on challenges in adjusting marketing techniques to meet the service needs of organizations. Prerequisite(s): MKTG 3650 (non-business majors may complete MKTG 2650).

**4800. Internship in Marketing or Logistics.** 3 hours. Supervised work in a job related to student's career objective or equivalent.

**4810. Special Topics in Marketing or Logistics.** 3 hours. Investigation, analysis and discussion of a variety of topics that are important in marketing and logistics. Topics may include supply chain management, transportation,

logistics, distribution and channel management, product development and management, sales management, consultative and team selling, promotion, market segmentation and opportunity analysis, and strategic pricing. Prerequisite(s): completion of 9 hours of upper-division marketing courses.

**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): graduating senior status.

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

**4951. Honors College Capstone Thesis.** 3 hours. Major research project prepared by the student under the supervision of a faculty member and presented in standard thesis format. An oral defense is required of each student for successful completion of the thesis. Prerequisite(s): completion of at least 6 hours in honors courses; completion of at least 12 hours in the major department in which the thesis is prepared; approval of the department chair and the dean of the school or college in which the thesis is prepared; approval of the dean of the Honors College. May be substituted for HNRS 4000.

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## Master's Engineering Systems

see *Graduate Catalog*

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## Materials Science and Engineering

### *Materials Science and Engineering, MTSE*

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

**3010. Bonding and Structure.** 3 hours. Amorphous and crystalline structures in metals, ceramics and polymers, point defects in crystals, structure determination by X-ray diffraction. Prerequisite(s): MFET 3450.

**3020. Microstructure and Characterization of Materials.** 3 hours. Introduction to dislocations, grain boundaries, surfaces and multiphase microstructures. Optical and electron microscopic characterization of microstructures. Prerequisite(s): MFET 3450.

**3030. Thermodynamics and Phase Diagrams.** 3 hours. First three laws of thermodynamics; phase equilibria, reaction equilibria and solution theory. Principles and applications of phase diagrams. Prerequisite(s): MFET 3450.

**3040. Transport Phenomena in Materials.** 3 hours. Principles of transport phenomena (momentum, heat and mass transport) in materials processes including heat, mass and momentum transport. Emphasis on applications of appropriate differential equations and boundary conditions to solve real materials processing problems. Prerequisite(s): MATH 3310 and MFET 3450.

**3050. Mechanical Properties of Materials.** 3 hours. Macroscopic mechanical response of ceramics, metals, polymers and composite materials, with an introduction to the underlying microstructural processes during deformation and fracture. Prerequisite(s): MFET 3450.

**3060. Phase Transformations in Materials.** 3 hours. Principles of structural transformations in materials. Thermodynamics and kinetics of nucleation, growth, precipitation and martensitic reactions. Prerequisite(s): MTSE 3030 and 3040.

**3070. Electrical, Optical and Magnetic Properties of Materials.** 3 hours. Bonding and the electronic structure and properties of metallic, ceramic, semiconducting and polymeric materials. Prerequisite(s): MFET 3450.

**3080. Materials Processing.** 3 hours. Basic principles and strategies for processing metals, ceramics, polymers, composites and electronic materials. Prerequisite(s): MTSE 3040.

**3090. Materials Science and Engineering Laboratory I.** 1 hour. (0;1) Laboratory designed to introduce students to some of the most common materials testing and characterization methods. Topics include optical metallography, tensile testing, hardness testing, impact testing, heat treating, melting and casting. Prerequisite(s): MFET 3450.

**3100. Materials Science and Engineering Laboratory II.** 1 hour. (0;1) Sequel laboratory designed to continue to introduce students to some of the most common materials testing and characterization methods. Topics include differential scanning calorimetry, rheology, powder processing and sintering, density, scanning electron microscopy, and x-ray diffraction. Prerequisite(s): MTSE 3090.

**4010. Physical Metallurgy Principles.** 3 hours. Physical metallurgy principles with a focus on understanding structure-property relationships in metals and alloys. Topics include structure, dislocations, mechanical behavior, grain boundaries, annealing, recrystallization, grain growth, diffusion, phase diagrams, transformations, strengthening mechanisms, fatigue, creep and fracture. Emphasis on the basic structure-property-processing relationships in metals and how they differ from other material classes. Prerequisite(s): MTSE 3010, 3030 and 3040.

**4020. Materials in Medicine.** 3 hours. The science and engineering of materials having medical applications. Provides students with an understanding of the challenges that materials (metals, polymers and ceramics) face/create during short- and long-term contact with mammalian physiology. Develops the student's understanding of the relationships controlling acceptance or failure of a given material in the body. Exposes students to strategies used in current and future biomaterials. Prerequisite(s): MTSE 3010 and 3050.

**4030. Ceramic Science and Engineering.** 3 hours. Emphasis on structure-property relationships: chemical bonding, crystal structures, crystal chemistry, electrical properties, thermal behavior, defect chemistry. Processing topics: powder preparation, sol-gel synthesis, densification, toughening mechanisms. Materials topics: glasses, dielectrics, superconductors, aerogels. Prerequisite(s): MTSE 3010, 3020, 3040.

**4040. Computational Materials Science.** 3 hours. Introduction to the basic principles used to simulate, model and visualize the structure and properties of materials. Topics include the various methods used at different length and time scales ranging from the atomistic to the macroscopic. Prerequisite(s): MTSE 3010 and 3030; MATH 3310.

**4050. Polymer Science and Engineering.** 3 hours. Chemical structures, polymerization, molar masses, chain conformations. Rubber elasticity, polymer solutions, glassy state and aging. Mechanical properties, fracture mechanics and viscoelasticity. Dielectric properties. Polymer liquid crystals. Semi-crystalline polymers, polymer melts, rheology and processing. Thermal analysis, microscopy, diffractometry and spectroscopy of polymers. Computer simulations of polymer-based materials. Prerequisite(s): MFET 3450.

**4060. Materials Selection and Performance.** 3 hours. Integration of structure, properties, processing and performance principles to formulate and implement solutions to materials engineering problems. Prerequisite(s): MTSE 3030, 3040 and 3050.

**4070. Electronic Materials.** 3 hours. Intensive study of electronic, optical and magnetic properties of materials with an emphasis on the fundamental physics and chemistry associated with these material systems. Prerequisite(s): MFET 3450 and MATH 3310.

**4090. Senior Research Project I.** 2 hours. Provides students with experience in research and development. Students pick a faculty mentor for this class and attend bi-weekly meetings with the other students to discuss progress, strategies, outcomes, etc. Designed primarily for the students to do a literature survey on the selected topic and a research plan to be initiated either late in the semester or in the follow-on course in the subsequent semester. Prerequisite(s): MTSE 3010, 3020, 3030, 3040, 3050, 3070 and 3080.

**4100. Senior Research Project II.** 2 hours. Follow-on course from MTSE 4090, Senior Research Project I. Students continue to work with the same faculty mentor for this class and will continue to attend bi-weekly meetings with the other students to discuss progress, strategies, outcomes, etc. Designed primarily for the students to perform the proposed research plan established in MTSE 4090. Prerequisite(s): MTSE 4090.

**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.

**4580. Materials for a Sustainable Environment.** 3 hours. Properties of renewable and nonrenewable, sustainable and non-sustainable materials, effects of product application and needs on material choices for a sustainable environment; degradation mechanisms; and influence of the environment on mechanisms. Prerequisite(s): CHEM 1415 or equivalent or CHEM 1410/1430; PHYS 1710/1730; MATH 1710.

**4900. Special Topics in Materials Science and Engineering.** 1–3 hours (maximum of 8 credits). Lectures, laboratory or other experiences covering specially selected topics in materials science and engineering. Prerequisite(s): MATH 1710, CHEM 1410/1430. May be repeated as topics vary.

**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.

**4951. Honors College Capstone Thesis.** 3 hours. Major research project prepared by the student under the supervision of a faculty member and presented in standard thesis format. An oral defense is required of each student for successful completion of the thesis. Prerequisite(s): completion of at least 6 hours in honors courses; completion of at least 12 hours in the major department in which the thesis is prepared; approval of the department chair and the dean of the school or college in which the thesis is prepared; approval of the dean of the Honors College. May be substituted for HNRS 4000.

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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 languages such 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.

**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 of 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 a grade of C or better. *Satisfies the Mathematics requirement of the University Core Curriculum.*

**1350 (MATH 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 (MATH 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.*

**1580 (MATH 1332). Survey of Mathematics with Applications.** 3 hours. Topics include probability, statistics, algebra, logic and the mathematics of finance. Additional topics are selected from geometry, sets, cryptography, fair division, voting theory and graph theory. Emphasis on applications. Recreational and historical aspects of selected topics are also included. Technology is used extensively. MATH 1580 is not intended to prepare students for calculus, science, engineering or business courses. Prerequisite(s): two years of high school algebra and one year of high school geometry and consent of department, or MATH 1010 with a grade of C or better. *Satisfies the Mathematics requirement of the University Core Curriculum.*

**1600 (MATH 1316). Trigonometry.** 3 hours. Trigonometry based on both right triangles and the unit circle: graphs of trigonometric functions; inverse trigonometric functions; trigonometric identities and equations; laws of sines and cosines; polar coordinates; DeMoivre's theorem; vectors. MATH 1600 and 1610 together cover approximately the same material as MATH 1650. Students who already have credit for MATH 1650 may not receive credit for MATH 1600. Prerequisite(s): MATH 1100 with a grade of C or better. *Satisfies the Mathematics requirement of the University Core Curriculum.*