**Department of Mathematics and Computer Science**

*Web Site: [http://www.twu.edu/math-computer-science/](http://www.twu.edu/math-computer-science/)*

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**Graduate Degrees Offered**

- **M.S. in Informatics** ([http://catalog.twu.edu/graduate/arts-sciences/mathematics-computer-science/informatics-ms](http://catalog.twu.edu/graduate/arts-sciences/mathematics-computer-science/informatics-ms))  
- **M.S. in Mathematics** ([http://catalog.twu.edu/graduate/arts-sciences/mathematics-computer-science/mathematics-ms](http://catalog.twu.edu/graduate/arts-sciences/mathematics-computer-science/mathematics-ms))  
- **M.S. in Mathematics Teaching** ([http://catalog.twu.edu/graduate/arts-sciences/mathematics-computer-science/mathematics-teaching-ms](http://catalog.twu.edu/graduate/arts-sciences/mathematics-computer-science/mathematics-teaching-ms))  
- **M.A.T. (Interdisciplinary)** ([http://catalog.twu.edu/graduate/professional-education/mat-graduate-interdisciplinary-degree](http://catalog.twu.edu/graduate/professional-education/mat-graduate-interdisciplinary-degree))

The Department of Mathematics and Computer Science offers graduate studies leading to the following degrees: Master of Science in Informatics, Master of Science in Mathematics and Master of Science in Mathematics Teaching.

The Master of Science prepares the student to enter the workforce or to pursue doctoral degree programs in informatics, data science, mathematics, statistics, applied mathematics, or related fields.

The Master of Science in Mathematics also provides the student an opportunity to include computer science and statistics in the plan of study. An emphasis in applied mathematics is available for those desiring to pursue further graduate study, pursue a career in a mathematics-related area in industry or government, or teach at the community college level. An emphasis in statistics is available for those interested in careers as applied statisticians or statistical programmers.

The Master of Science in Mathematics Teaching is especially designed for elementary or secondary school teachers of mathematics. Course work emphasizes topics needed for the elementary or secondary mathematics teacher. The department also provides a plan of study designed to prepare current teachers for Master Mathematics Certification at the 4-8 or 8-12 level.

The Master of Arts in Teaching (M.A.T.) degree offered through the College of Professional Education prepares graduate students to be future mathematics teachers at the 4-8 or the 7-12 levels in mathematics or the 8-12 level in computer science. Mathematics or computer science courses required for the degree are determined in consultation with a departmental advisor.

**M.S. in Informatics**

Informatics is the study and application of information science, computer science, cognitive science, and organizational science to the arts, sciences, and professions. The Master of Science program in Informatics ([http://catalog.twu.edu/graduate/arts-sciences/mathematics-computer-science/informatics-ms](http://catalog.twu.edu/graduate/arts-sciences/mathematics-computer-science/informatics-ms)) at TWU provides students with a flexible, adaptable, interprofessional, and interdisciplinary approach to the study of Informatics in a hybrid learning environment. The program will provide students with the skills needed for success in high-demand professions and careers in the areas of Clinical Informatics, Data Science/Data Analytics, Health Studies, Sports Informatics, and Community Informatics. The program is delivered collaboratively by Academic Components including Computer Science, Nursing, Health Studies, Kinesiology, and Library and Information Studies.

**Certifications**

- **Post-Baccalaureate Certificate in Interprofessional Informatics** ([http://catalog.twu.edu/graduate/nursing/pb-certificate-interprofessional-informatics](http://catalog.twu.edu/graduate/nursing/pb-certificate-interprofessional-informatics)) (offered through the College of Nursing)

**Minors**

Graduate students in other departments who desire concentrated study in mathematics, informatics, or computer science as a related field should contact the Department of Mathematics and Computer Science to discuss an appropriate plan of study.

**Faculty**

- **BANKS, CATHERINE CLEAVELAND**, Senior Lecturer of Mathematics, B.S., Stephen F. Austin State University; M.S., Stephen F. Austin State University  
- **DEMUYNCK, MARIE-ANNE**, Professor of Computer Science, B.A., Catholic University of Leuven; M.A., Catholic University of Leuven; M.S., Texas Woman’s University; Ph.D., University of North Texas  
- **FALLEY, BRANDI N.**, Associate Professor of Mathematics, B.A., Ouachita Baptist University; M.S., Baylor University; Ph.D., Baylor University  
- **GARDNER, DAVID M.**, Associate Professor of Computer Science, B.B.A., University of North Texas; M.S., University of North Texas; Ph.D., University of North Texas  
- **GRIGORIEVA, ELLINA**, Professor of Mathematics, B.S., Lomonosov Moscow State University; M.S., Lomonosov Moscow State University; Ph.D., Lomonosov Moscow State University  
- **HILDERBRANDT, JAMES S.**, Associate Professor of Mathematics, B.S., Texas Christian University; M.S., Texas Christian University; Ph.D., Texas Tech University  
- **HUNTER, JOEL D.**, Associate Professor of Mathematics, B.S., University of Texas at San Antonio; M.S., Texas State University; Ph.D., University of North Texas  
- **MALLAM, WINIFRED A.**, Associate Professor of Mathematics, B.A., Shaw University; M.S.S.E., Texas Woman’s University; Ph.D., University of Jos  
- **NAVARRA-MADSEN, JUNALYN**, Professor of Mathematics, B.S.Ed., University of St. La Salle; M.S., University of Texas at Dallas; Ph.D., University of Texas at Dallas  
- **SMITH, SHAWNDA**, Assistant Professor of Mathematics, B.A., University of Texas at Austin; M.A., University of Texas at Austin; Ph.D., Texas State University  
- **WHEELER, ANN M.**, Associate Professor of Mathematics, B.S., Henderson State University; M.S.E., Henderson State University; Ph.D., University of Northern Colorado
**Courses**

**Computer Science Courses**

**CSCI 5103. Fundamentals of Informatics.** Fundamental computing concepts for informatics study. Topics include problem-solving logic and algorithms, data management, information and knowledge discovery, security and ethics issues related to informatics, technology project management, user interface, and interprofessional application of informatics in specific fields’ case studies. Prerequisites: Computer competence and experience with data analysis applications such as spreadsheet software. Three lecture hours a week. Credit: Three hours.

**CSCI 5203. Database Systems.** Design, implementation, and use of relational database systems (model and query language SQL). Examination of file organization, database storage, indexing and hashing, query evaluation and optimization, transaction processing, concurrency control and recovery, and database integrity and security. Investigation of latest developments in other large-scale data management techniques and systems. Prerequisite: CSCI 5103 or permission of instructor. Three lecture hours a week. Credit: Three hours.

**CSCI 5413. Data Communication Networks.** Analysis of networks and data communication avenues to gather, transfer, manage, and manipulate data for making contextualized data-driven decisions; network and communication security and integrity to support private and confidential data contexts; strengths and weaknesses of communication technologies at various levels and contexts. Prerequisite: CSCI 5103 or permission of instructor. Three lecture hours a week. Credit: Three hours.

**CSCI 5443. Human-Computer Interface.** Critique, refinement, and creation of intermediate and advanced human/computer interfaces; stakeholder needs and data flexibility/transferability of technical interfaces; traditional, mobile, and wearable computing. Prerequisite: CSCI 5103 and knowledge of web/scripting language, or permission of instructor. Three lecture hours a week. Credit: Three hours.

**CSCI 5513. Data and Information Visualization.** Transformation of data into interactive visual representations for effective analytical reasoning and decision making; acquisition, preparation, and analysis of large data sets; techniques, algorithms, and software tools to create visualizations; techniques for analytical reasoning and data representation and transformation to support production, presentation and dissemination of visualization results. Prerequisite: CSCI 5103. Three lecture hours a week. Credit: Three hours.

**CSCI 5573. Foundations of Data Science.** Extraction of knowledge from data requiring an integrated skill set spanning statistics, machine learning, databases, algorithms, and other branches of computer science. Concepts, techniques, and tools needed for diverse facets of data science practice, including data collection and integration, data cleaning, exploratory data analysis, predictive and other types modeling, visualization and animation, evaluation, interpretation, and effective communication. Prerequisite: CSCI 5103. Three lecture hours a week. Credit: Three hours.

**CSCI 5643. Internet/Intranet Services: Design and Implementation.** Design and implementation of Internet/Intranet network information services including FTP, World Wide Web, and conferencing. Preparation and integration of digital graphics, animation, video, audio, and script-based (Java/Java Script) content. Students will design and build an intranet, install and maintain servers, and prepare multimedia rich content. Prerequisite: CSCI 1403, CSCI 3002, or equivalents. Three lecture hours a week. Credit: Three hours.

**CSCI 5653. Technology Issues, Achievements and Challenges in Education.** Current developments and open research issues for technology in education. Includes current and future trends in multimedia, simulation, communication, networks, AI, intelligent tutoring systems, learning communities, learning technologies, security concerns, communication strategies, ethical, and leadership issues. Prerequisites: Permission of instructor. Three lecture hours a week. Credit: Three hours.

**CSCI 5663. Statistical Programming.** Design of statistical programs to manipulate raw data, generate reports, and analyze data. Numerous case studies demonstrate appropriate analysis based on the experimental design. Advanced statistical research methods such as ANOVA, MANOVA, repeated measures ANOVA, Multiple Linear and Logistic regression, factor analysis, and survival analysis SAS. Prerequisite: Six hours undergraduate statistics, or three hours graduate level statistics, or equivalent. Three lecture hours a week. Credit: Three hours.

**CSCI 5673. Big Data: Management, Access, and Use.** Fundamentals of big data and big data analytics; NoSQL systems and tools and techniques used in big data scenarios. Exploration of the big data phenomenon from multiple perspectives: historical, theoretical, statistical, philosophical, ontological, and ethical. Possible solutions to the problems of big data involving compression, mining, database design, visualization, interface design, security, management, and use, with application to multiple fields. Prerequisite: CSCI 5103. Three lecture hours a week. Credit: Three hours.

**CSCI 5793. Statistical Computer Packages.** Survey of major statistical computation program systems with special emphasis on SPSSX and BMDP. Basic concepts of control language and data set preparation, program execution, and interpretation of statistical program output. Prerequisite: Intermediate statistics or permission of the instructor. Three lecture hours a week. Credit: Three hours.

**CSCI 5803. Data Warehousing.** Design, implementation, and management of data warehouse systems and their applications; requirements for gathering data for data warehousing; data warehouse architecture; dimensional model design for data warehousing; physical database design for data warehousing; extracting, transforming, and loading strategies; design and development of intelligence applications for decision support, and expansion and support of a data warehouse. Prerequisite: CSCI 5203. Three lecture hours a week. Credit: Three hours.

**CSCI 5813. Concepts of Data Warehousing and Data Mining.** Review of the basic concepts of file systems, databases, data warehousing, data mining, and related statistics. Summary of database management, modeling, design, and life cycle is provided as related to data warehousing. Methods for extracting information from a large database by use of data mining techniques are studied. Techniques include: machine learning, decision algorithms, statistical modeling, and clustering. Prerequisites: CSCI 3423 and MATH 1713, or equivalent. Three lecture hours a week. Credit: Three hours.

CSCI 5893. Statistical Packages II. A further survey of major statistical computation program systems. Concepts of control language and data set preparation, program execution, and interpretation of statistical program output will be studied. Prerequisite: CSCI 5793. Three lecture hours a week. Credit: Three hours.

CSCI 5903. Special Topics. Variable content. May be repeated for additional credit. Three lecture hours a week. Credit: Three hours.

CSCI 5913. Independent Study. Selected topics in advanced computer science. May be repeated for additional credit. Credit: Three hours.

CSCI 5921. Statistical Analysis With Computers. Exposure to available University resources in research design and data analysis, including fully computerized statistical analysis techniques. Appropriate for graduate students who are at least in the proposal/prospectus phase. May be repeated for additional credit. Prerequisite: Permission of the instructor. Credit: One hour.

CSCI 5923. Capstone in Informatics. Culminating organization and/or community-based interdisciplinary/interprofessional project supported through informatics and technology and applied to a specific domain to demonstrate knowledge and skills acquired in the informatics program. Immersive, investigative, and reflective opportunity for deep study on a selected area of practice/application domain. Prerequisite: Completion of 24 semester credit hours. Credit: Three hours.

CSCI 5953. Cooperative Education. Cooperative work-study arrangement between business, industry, or selected institutions with the University. Nine practicum hours a week. Credit: Three hours.

CSCI 5981. The Professional Portfolio. Development of a professional portfolio by students in the Master of Arts in Teaching program demonstrating the student's growth in the Learner-Centered Competencies. Pass-fail grade only. May be repeated. Credit: One hour.

**Mathematics Courses**

MATH 5033. Advanced Calculus. Development of the limit processes including continuity, sequences, series, differentiation, and integration. Emphasis on proofs of the fundamental theorems of mathematical analysis, including Rolle's and Lagrange's theorems. Multivariable analysis, constrained optimization. Prerequisite: Permission of advisor. Three lecture hours a week. Credit: Three hours.

MATH 5203. Problem Solving in the Math Classroom. Study of problems with multiple solutions or alternative approaches in grades 4-12; strategies for solving problems; assessment techniques; cooperative grouping methods; critical thinking skills. Three lecture hours a week. Credit: Three hours.

MATH 5303. Algebra in the Mathematics Classroom. Topics in algebra with an emphasis in problem solving, patterns, relationships, order pairs, prime and composite numbers, orders of operations, exponents number sentences, ratios, proportions, percents, modeling, formulas, equations, graphs, functions, and systems of equations. Three lecture hours a week. Credit: Three hours.

MATH 5313. Geometry in the Mathematics Classroom. Topics in geometry with an emphasis in problem solving, shapes, angles, polygons, circles, Pythagorean Theorem, symmetry, transformations, measurement of area, and volume with an emphasis on technology. Three lecture hours a week. Credit: Three hours.

MATH 5323. Euclidean Geometry. Euclidean geometry from a problem solving approach. Topics include shapes, measurement, perimeter, area, volume, geometric proofs, congruence, triangles, quadrilaterals, similarity, circles, and coordinate geometry. Three lecture hours a week. Credit: Three hours.

MATH 5333. Technology in the Math Classroom. Technologies and their use in teaching mathematical concepts in grades 4-12; includes graphing calculators, and computer software programs and pedagogical technology. Prerequisite: Permission of academic advisor. Three lecture hours a week. Credit: Three hours.

MATH 5423. History of Mathematics. A survey of the historical development of various mathematical topics, including geometry, algebra, and number theory. A study of the work of past mathematicians, including Archimedes, Euclid, Fermat, Newton, and mathematicians of the 19th and 20th centuries. Three lecture hours a week. Credit: Three hours.

MATH 5483. Theory of Probability and Statistics I. Basic principles of probability; combinations and permutations; conditional probability and independence; common discrete and continuous probability distributions, their properties, and applications. Three lecture hours a week. Credit: Three hours.

MATH 5493. Theory of Probability and Statistics II. Sampling distribution theory and the Central Limit Theorem; point and interval estimation; hypothesis testing. Prerequisite: MATH 5483 or equivalent. Three lecture hours a week. Credit: Three hours.


MATH 5523. Introduction to Number Theory. Understanding and creating proofs related to divisibility, congruences, Diophantine equations, and applications. Three lecture hours a week. Credit: Three hours.

MATH 5543. Symbolic Logic. Development of Symbolic Logic as a mathematical system. Starting with axioms and definitions, theorems will be proved. Application of Symbolic Logic to set theory is considered. Three lecture hours a week. Credit: Three hours.

MATH 5573. Statistical Methods I. Probability distributions, graphical representations, curve fitting, hypothesis testing, regression and correlation, and applications. Prerequisite: Permission of the instructor. Three lecture hours a week. Credit: Three hours.

MATH 5583. Statistical Methods II. Statistical research tools including analysis of variance, chi-square tests, regression (simple and multiple), logistic regression, correlation, non parametric method, and survival analysis. Use of SPSS for the PC. Prerequisite: MATH 5573 or consent of instructor. Three lecture hours a week. Credit: Three hours.

MATH 5593. Differential Equations. The existence and uniqueness for differential equations and systems of differential equations. General theory to specific types of differential equations of a single variable. Basic theory for linear and non-linear systems; linearization; stability; Hamiltonian Systems; applications with MAPLE. Three lecture hours a week. Credit: Three hours.

MATH 5863. Applied Statistics and Convex Optimization. Organizing, analyzing, and summarizing data through statistical methods. Combination of computational and statistical methods and convex optimization techniques to find solutions to big data found in diverse fields such as business, engineering, biological, and health sciences. Regularized and large-scale modeling techniques such as boosting and the lasso as well as model averaging techniques. Consideration of both Frequentist and Bayesian perspectives. Prerequisites: Calculus, probability, and statistical concepts; or permission of instructor. Three lecture hours a week. Credit: Three hours.

MATH 5873. Real Analysis and Topology. Metric Spaces and Measure and Integration Theories such as integration theory on general measure spaces including the Lebesgue integral and Lebesgue-Stieltjes integral on the line, Lusin's Theorem, Egoroff's Theorem, Fatou's Lemma, and the Monotone and Dominated Convergence Theorems. Prerequisite: MATH 4873 or equivalent. Three lecture hours a week. Credit: Three hours.

MATH 5883. Algebraic Geometry. The connection between algebra and geometry via problem-solving and visualization techniques: topics including conics, cubics, quartics and higher-degree curves, and real-world applications such as modern cryptography. Prerequisite: MATH 5513. Three lecture hours a week. Credit: Three hours.

MATH 5903. Special Topics. Variable content. May be repeated for additional credit. Three lecture hours a week. Credit: Three hours.

MATH 5911. Independent Study. Selected topics in advanced mathematics. May be repeated for additional credit. Credit: One hour.

MATH 5913. Independent Study. Selected topics in advanced mathematics. May be repeated for additional credit. Credit: Three hours.

MATH 5953. Cooperative Education. Cooperative work-study arrangement between business, industry, or selected institutions with the University. Nine practicum hours a week. Credit: Three hours.

MATH 5973. Professional Paper. Credit: Three hours.

MATH 5981. The Professional Portfolio. Development of a professional portfolio by students in the Master of Arts in Teaching program demonstrating the student's growth in the Learner-Centered Competencies. Pass-fail grade only. May be repeated. Credit: One hour.

MATH 5983. Thesis. Credit: Three hours.

MATH 5993. Thesis. Prerequisite: MATH 5983. Credit: Three hours.