DEPARTMENT OF MATHEMATICAL, COMPUTING, AND INFORMATION SCIENCES

Department Head: Dr. Vijaya Gompa, vgompa@jsu.edu

MS in Computer Science and Software Design Graduate Coordinator: Dr. Eric Gamess, egamess@jsu.edu

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The Department of Mathematical, Computing, and Information Sciences offers courses leading to the Master of Science (MS) with a major in Mathematics and the Master of Science (MS) with a major in Computer Systems and Software Design with two concentrations, as well as supporting courses for the Master of Arts (MA) degree with a major in Integrated Studies. Students pursuing graduate degrees in Secondary Education who meet Mathematical, Computing, and Information Sciences Department admission requirements may take mathematics courses in their teaching field.

• Computer Systems and Software Design - General (Master of Science) (catalog.jsu.edu/graduate/science/mathematics-computing-information-sciences/computer-systems-software-design-general-ms/)
• Computer Systems and Software Design - Information Security and Assurance (Master of Science) (catalog.jsu.edu/graduate/science/mathematics-computing-information-sciences/computer-systems-software-design-information-security-assurance-ms/)
• Mathematics (Master of Science) (catalog.jsu.edu/graduate/science/mathematics-computing-information-sciences/mathematics-ms/)

NOTE: Prerequisite for all Mathematics Courses. Graduate courses in Mathematics are open only to students who:

1. Are admitted to a graduate program of study in Mathematics; or
2. Are admitted to a graduate program of study in Secondary Education with a teaching field of Mathematics and with all undergraduate deficiencies in Mathematics removed; or
3. Have completed 32 semester hours in Mathematics with at least 19 upper division hours.
4. In addition, students must have successfully completed at least one course equivalent to MS 415 Advanced Calculus I (3) or MS 441 Abstract Algebra I (3).
5. Some individual courses have further prerequisites; see the course descriptions below. Exemptions from course prerequisites require permission of the department head.

Mathematics

MS 403 Vector Analysis (3)
Prerequisite(s): MS 227
Algebra and calculus of vectors, Stokes theorem, and divergence theorem; applications to geometry, mass potential functions, electricity, and fluid flow.

MS 404 Mathematical Statistics II (3)
Prerequisite(s): MS 227 and 304.
Continuation of MS 304. The Central Limit Theorem, order statistics, functions of random variables, properties of estimators, confidence intervals, hypothesis testing, and least squares regression models.

MS 416 Advanced Calculus II (3)
Prerequisite(s): MS 415.
Selected topics from advanced calculus, including differentiable functions, the Riemann integral, and sequences and series of functions.

MS 423 A Survey of Geometries (3)
Prerequisite(s): MS 323.
Selected topics from advanced Euclidean geometry, finite geometries, non-Euclidean geometry, and other geometries.

MS 451 Functions of a Complex Variable (3)
Prerequisite(s): MS 227.
Undergraduate Prerequisite: MS 227 and 300 and 415. Graduate Fundamental operations with complex numbers, differentiation and integration theorems, mapping, series, and residues.

MS 475 Seminar in Mathematics (3)
Prerequisites or corequisites for undergraduate: MS 415 or MS 441 or MS 451. Prerequisites or corequisites for graduate: MS 415 or MS 441. Goals include examining deeply the fundamental ideas of mathematics and connections among various branches of mathematics, exploring the historical development of major concepts, and further developing the habits of mind that define mathematical approaches to problems.

MS 480 Introductory Topology (3)
Prerequisite(s): MS 415.
Basic topological concepts to include topological spaces, mapping, compactness, connectedness, and separation axioms.

MS 484 Partial Differential Equations (3)
Prerequisite(s): MS 227 and 344.
Standard methods of solution; separation of variables, Fourier Series, Laplace Transforms; selected applications.

MS 504 Applied Statistical Methods (3)
Prerequisite(s): Undergraduate minor in mathematics or approval of instructor.
Fundamental concepts of descriptive and inferential statistics, probability distributions, estimation, and hypothesis testing; statistical software packages are used to facilitate valid analysis and interpretation of results; emphasis is on method and selection of proper statistical techniques for analyzing real situations.

MS 505 Basic Logic and Set Theory (3)
Prerequisite(s): MS 300 or 415 or 441.
Basic topics in symbolic logic and naive set theory, including sets and set operations, symbolic logic, the language of set theory, and applications of set theory.

MS 515 Real Variables I (3)
Prerequisite(s): MS 416 or approval of instructor.
Selected topics from real analysis with emphasis on functions of one and several variables, measure, and the Riemann and/or Darboux integral.

MS 516 Real Variables II (3)
Prerequisite(s): MS 515.
Selected topics from real analysis emphasizing Lebesgue integration, sequences and series of functions.
MS 517 Introduction to Functional Analysis (3)
Prerequisite(s): MS 352 and MS 415.
Introduction to the fundamental topics of functional analysis. Topics include metric spaces, completeness, linear operators, normed spaces and Banach spaces, inner product spaces, and Hilbert spaces. Objectives include the Riesz Representation Theorem, the Hahn-Banach Theorem, and the Contraction Mapping Theorem.

MS 523 Topics in Geometry for Teachers (3)
Prerequisite(s): Undergraduate minor in mathematics.
Classical theorems, ideas, and constructions of Euclidean and non-Euclidean geometry in the theorems of Ceva, Manalaus, Pappus, and Feuerback; homothetic transformations, inversion, harmonic sets of points, and cevians.

MS 526 Topics in Analytical Geometry for Teachers (3)
Prerequisite(s): Undergraduate minor in mathematics.
Applications of Euclidean and homogeneous coordinates, geometric transformations, trigonometric, and vector techniques to geometric problems.

MS 528 Theory of Equations and Functions for Teachers (3)
Prerequisite(s): Undergraduate minor in mathematics.
Topics in the theory of polynomial and other equations, and in the properties of transcendental functions. The goal is the development of a deeper understanding of the equations and functions commonly encountered in precalculus mathematics. May require the use of computer software.

MS 530 Foundations in Calculus for Teachers (3)
Prerequisite(s): Undergraduate minor in mathematics.
Theory, problem solving techniques, and applications of differential and integral calculus, including the use of graphing calculators and computer software. Recommended for students who are teaching or planning to teach Advanced Placement Calculus.

MS 533 Topics in Modern Analysis for Teachers (3)
Prerequisite(s): Undergraduate minor in mathematics.
Logic and set theory, functions and sequences, structure and development of the real number system including completeness. Course designed for students majoring in secondary education with a teaching field in mathematics.

MS 535 Topics in Finite Mathematics for Teachers (3)
Prerequisite(s): Undergraduate minor in mathematics.
Elementary combinatorial analysis, probability, vectors and matrices, game theory, linear programming, and model building in the social and physical sciences. Course designed for students majoring in secondary education with a teaching field in mathematics.

MS 537 Foundations in Algebra for the Secondary Teacher (3)
Prerequisite(s): MS 441 or equivalent.
Concepts of high school algebra from the perspective of ring theory.

MS 541 Abstract Algebra I (3)
Prerequisite(s): MS 441 or equivalent.
General group theory including cyclic groups and permutation groups, homomorphism and isomorphism theorems.

MS 542 Abstract Algebra II (3)
Prerequisite(s): MS 541.
Theory of rings, ideals, fields, and integral domains.

MS 549 Selected Topics in Mathematics for the Secondary Teacher (3)
Prerequisite(s): Undergraduate minor in mathematics or approval of instructor.
Selected topics suitable for the secondary teacher; problem solving; secondary school mathematics from an advanced standpoint.

MS 552 Linear Algebra (3)
Prerequisite(s): MS 352 and MS 441 or equivalent.
Abstract treatment of finite dimensional vector spaces. Linear transformations, determinants, eigenvalues and eigenvectors, invariant subspaces, Rational and Jordan Canonical Forms, inner product spaces, unitary and normal operators, bilinear forms.

MS 591 Seminar in Algebra (3)
Prerequisite(s): MS 541 and 542 or approval of instructor.
Selected topics in modern algebra beyond the scope of the graduate algebra sequence. Topics may be chosen from the theory of groups, rings, fields, or modules; linear algebra; homological algebra; or other topics, depending on student and instructor interests. May be duplicated for credit for a total of 6 semester hours.

MS 595 Seminar in Analysis (3)
Prerequisite(s): MS 515 and 516 or approval of instructor.
Selected topics in modern analysis beyond the scope of the graduate analysis sequence. Topics may be chosen from the fields of real analysis (measure theory and integration, special functions, finite differences, functional equations, sequences and series), complex variables, Fourier and harmonic analysis, integral transforms, operator theory, or other topics, depending on student and instructor interests. May be duplicated for credit for a total of 6 semester hours.

MS 598 Directed Readings (3)
Prerequisite(s): Students must have two courses in the topical area chosen and approval by the faculty advisor in mathematics and the instructor.
Algebra, analysis, geometry, and topology. May be duplicated for credit for a total of 6 semester hours.

MS 599 Thesis (3)
Prerequisite(s): Deans’ Approval and Approval of application for thesis option.
See "Thesis Option and Procedures." May be duplicated for credit for a total of 6 semester hours. (Grade: Pass/Fail).

Computer Science

CS 501 Database Management Systems (3)
Prerequisite(s): A programming language.
Information as corporate resource, data modeling, database design, implementation strategies and administration; security, information centers, decision support systems, mini- and microcomputer environment; teams of students will design and implement a relational database application.

CS 502 Research Methods and System Evaluation (3)
Prerequisite(s): Undergraduate or graduate statistics course.
Introduction to the research techniques and methodologies used to evaluate systems such as control systems, computer systems, security systems, and information systems. Topics include methodological foundations, qualitative research methods and quantitative research methods.

CS 521 Applied Software Engineering I (3)
Prerequisite(s): Admission to the MS in SSD program or permission of instructor.
Focuses specifically on methods that guide software engineers from requirements to code; provides broad understanding of current methods, and specific skills in using these methods.
CS 523 Applied Software Engineering II (3)
Prerequisite(s): SSD major or permission of instructor.
Provides knowledge and skills necessary to lead a project team, understand the relationship of software development to overall product engineering, and understand the software process.

CS 525 Advanced Web Applications Using Web Services (3)
Prerequisite(s): Undergraduate software engineering course or equivalent.
Utilization of various technologies and tools for developing Web applications using Web Services, emphasizing organizational issues, challenges, and security concerns related to the effective deployment of those applications. Students will evaluate real-world applications of Web services as well as the unique decision-making framework involved with their adoption while employing those lessons learned in practical solutions.

CS 530 Human-Computer Interaction (3)
Prerequisite(s): Comprehensive undergraduate course in software engineering or industrial software engineering experience with a large project.
Human-computer interface, human performance, diversity, and mental models, interaction devices, dialog and interface styles, documentation, and usability testing.

CS 534 Emerging Software Architectures and Methodologies (3)
Prerequisite(s): Comprehensive undergraduate course in software engineering or industrial software engineering experience with a large project.
Explores emerging technologies and contemporary development methodologies for large scale software systems; difficulties and benefits of software by component composition, component reuse and software architectures.

CS 536 Computational Intelligence (3)
Prerequisite(s): Experience with an object oriented programming language.
Introducing concepts, models, algorithms, and tools for development of intelligent systems. Example topics include artificial neural networks, genetic algorithms, fuzzy systems, swarm intelligence, ant colony optimization, artificial life, and hybridizations of the above techniques. Additional focus will be placed on research methodologies and preparing research papers and reports.

CS 538 Business Intelligence and Data Mining (3)
Prerequisite(s): Undergraduate or graduate statistics course.
Introduction to business intelligence and data mining methodologies and tools that enable users to analyze new patterns/relationships and develop insight for decision making. This course provides students thorough conceptual framework, discussion, and hands-on experience in business intelligence and data mining. Techniques that the course covers include, but not limited to, linear modeling, decision trees, association rules, classification rules, clustering & visualization, text mining methodologies. Topics covered will include business intelligence, data mining methods, predictive analysis, information quality, and a term project that applies the skills learned.

CS 540 Bioinformatics Algorithms (3)
Prerequisite(s): Basic knowledge in probability and statistics, data structures, and algorithms.
Provides fundamental background in bioinformatics, both theoretical and practical, to students in computer science or biological sciences. Provides the principles that drive an algorithm’s design. Covers various topics such as DNA and RNA structure, gene structure and control, protein structure, sequence alignment production, homologous sequences searches, phylogenetic trees structure and interpretation.

CS 541 Digital Media: Theory and Processing (3)
Study of the fundamentals of image and video processing. This course will use a mathematical framework to describe and analyze images and videos as two- and three-dimensional signals in the spatial, spatio-temporal, and frequency domains. Techniques for image and video compression, morphological processing, segmentation, enhancement and recovery will be presented.

CS 544 Applied Artificial Intelligence (3)
Prerequisite(s): Undergraduate artificial intelligence course or equivalent. Survey of artificial intelligence emphasizing applications in business, industrial, and scientific system development; autonomous agents, data mining, pattern recognition, and machine vision.

CS 546 Advanced Management of Information Systems (3)
In-depth study of the theories of information systems and their relationship to organization, decision-making and information management processes. Topics include information systems' impact, strategic uses of information systems, technology adoption, enterprise computing architectures and infrastructures, information security and assurance, IT policy compliance, knowledge management and performance measurement.

CS 547 Wireless Networking and Security (3)
Prerequisite(s): SSD major or permission of instructor.
A study of advanced topics in computer networks with emphasis on wireless communications. Fundamentals of cellular communications, CDMA systems, wireless security, Wireless Application Protocols (WAP), Bluetooth, and new wireless technologies are also covered.

CS 550 Distributed Computing Systems (3)
Prerequisite(s): Undergraduate course in computer networking or equivalent.
Design and analysis of distributed computing systems; system architecture; load balancing and scheduling; remote procedure calls and message passing; distributed operating systems and database systems.

CS 556 Embedded and Real-Time Software Development (3)
Prerequisite(s): SSD major or permission of instructor.
In-depth study of requirements or real-time and embedded software; examination of operating systems, languages, and devices that support these systems; real-time multimedia applications emphasized.

CS 570 Advanced Computer Security (3)
Prerequisite(s): Undergraduate operating system course or equivalent. Study of advanced network security architectures, models, benchmarks and metrics, cryptography, authentication and authorization protocols, secure application and systems development, federal regulations and compliance, and advanced security topics on intrusion detection, biometrics, web services, and data mining. Emphasis is on security professional certification.
CS 591 Special Topics in Computer Science (3)
Prerequisite(s): Approval of the advisor and approval of the department head.
(3) (3). Selected topics from current problems in computing; topics vary from semester to semester.

CS 592 Special Topics in Computer Science (3)
Prerequisite(s): Approval of the advisor and approval of the department head.
Selected topics from current problems in computing; topics vary from semester to semester.

CS 595 Studio Component (3)
Prerequisite(s): Approval of the advisor and approval of department head.
Provides students with a laboratory for direct application of concepts learned in course work; students will produce a variety of software products.

CS 596 Studio Component (3)
Prerequisite(s): Approval of the advisor and approval of department head.
Provides students with a laboratory for direct application of concepts learned in course work; students will produce a variety of software products.

Distinguished Professor
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Professor
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