DEPARTMENT OF
MATHEMATICS AND COMPUTER SCIENCE

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Degrees Offered
M.S. in Computer and Information Science

Required Admission Test
GRE General Test

Graduate Faculty

Thir Dangal, PhD, Assistant Professor of Mathematics
Taipan Tiwari, PhD, Associate Professor of Mathematics
Lixin Yu, PhD, Professor of Computer and Information Science
Elizabeth Udemgba, PhD, Instructor of Mathematics
Ping Zhang, Chairperson and Assistant Professor of Computer Science

MASTER OF SCIENCE IN
COMPUTER AND INFORMATION SCIENCE

Program Description

This program is designed to meet the needs of two groups of students: those who have completed an undergraduate degree in Computer Sciences, and those with degrees in related fields who want to develop their knowledge and skill in computer science. Upon successful completion of a M.S. Degree program in Computer Science at Alcorn State University, students will demonstrate competence in the following core areas:

1. Theory of Computation
2. Design and Analysis of Algorithms
3. Computer Architecture
4. Operating Systems
5. Programming Languages
6. Programming skills in high level languages and ability to build software systems
7. Ability to conduct independent research and writing of technical reports and papers for Publication
8. Good oral and written communication skills
9. Ability to work in teams as productive members and as leaders

The program includes focus in specialty areas in the following:

Artificial Intelligence
Cyber Security
Database Management
Programming Languages

Admission Requirements:

Meet all Graduate Studies admission and University requirements.

Graduation Requirements:

1. Master degree candidates must complete a minimum 33 credit hours including at least 15 credit hours of required courses

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2. If the candidates' undergraduate major is not Computer Science or the following courses are not listed in their undergraduate transcripts, the candidates are required to take following courses to meet graduation requirements:

   2.1) if Discrete Mathematics course is not listed in the candidate's undergraduate transcript, the candidates are required to enroll one Discrete Mathematics course.

   2.2) if C++ or Java and Object Oriented Programming (OOP) courses are not listed in the candidate's undergraduate transcript, the candidates are required to take OOP and Data Structure course.

3. If GRE writing score is less than 3.0, the candidate needs to take CS561 course (Special Topic II in Computer Science), which course focuses on academic reading/writing, project and/or thesis composition.

4. Master degree candidates must complete either thesis (6 credit hours) or a research project (3 credit hours) or internship (3 credit hours).

Course Requirements (Thesis Plan)

Required Courses (18 Hours)		**Credits**
CS 521	Theory of Computation	3 hrs.
CS 523	Programming Languages	3 hrs.
CS 525	Operating Systems	3 hrs.
CS 527	Design and Analysis of Algorithms	3 hrs.
CS 590	Thesis*	6 hrs.
Elective Courses (15 Hours)		**Credits**
CS 529	Information Retrieval System I	3 hrs.
CS 531	Artificial Intelligence	3 hrs.
CS 533	Database Management Systems	3 hrs.
CS 535	Computer Architecture	3 hrs.
CS 537	Computer Graphics	3 hrs.
CS 539	Compiler Construction	3 hrs.
CS 540	Implementation of Adv. Algorithms	3 hrs.
CS 541	Software Engineering	3 hrs.
CS 543	Scientific Computation	3 hrs.
CS 545	Network and Telecom I	3 hrs.
CS 546	Network and Telecom II	3 hrs.
CS 547	Algorithms for Parallel Computers	3 hrs.
CS 553	Information Retrieval System II	3 hrs.
CS 555	Object-Oriented Programming and Data Structure	3 hrs.
CS 560	Special Topics I in Computer Science	3 hrs.
	TOTAL	**33 hrs.**

Course Requirements (Non-Thesis Plan)

Required Courses (15 Hours)		Credits
CS 521	Theory of Computation	3 hrs.
CS 523	Programming Languages	3 hrs.
CS 525	Operating Systems	3 hrs.
CS 527	Design and Analysis of Algorithms	3 hrs.
CS 580	Research Project *	3 hrs.

Elective Courses (18 Hours)		Credits
CS 529	Information Retrieval System I	3 hrs.
CS 531	Artificial Intelligence	3 hrs.
CS 533	Database Management Systems	3 hrs.
CS 535	Computer Architecture	3 hrs.
CS 537	Computer Graphics	3 hrs.
CS 539	Compiler Construction	3 hrs.
CS 540	Implementation of Adv. Algorithms	3 hrs.
CS 541	Software Engineering	3 hrs.
CS 543	Scientific Computation	3 hrs.
CS 545	Network and Telecom I	3 hrs.
CS 546	Network and Telecom II	3 hrs.
CS 547	Algorithms for Parallel Computers	3 hrs.
CS 553	Information Retrieval System II	3 hrs.
CS 555	Object-Oriented Programming and Data Structure	3 hrs.
CS 560	Special Topics I in Computer Science	3 hrs.
	TOTAL	**33 hrs.**

Course Requirements (Internship Plan)

Required Courses (15 Hours)		Credits
CS 521	Theory of Computation	3 hrs.
CS 523	Programming Languages	3 hrs.
CS 525	Operating Systems	3 hrs.
CS 527	Design and Analysis of Algorithms	3 hrs.
CS 581	Internship*	3 hrs.

Elective Courses (18 Hours)		Credits
CS 529	Information Retrieval System I	3 hrs.
CS 531	Artificial Intelligence	3 hrs.
CS 533	Database Management Systems	3 hrs.
CS 535	Computer Architecture	3 hrs.
CS 537	Computer Graphics	3 hrs.
CS 539	Compiler Construction	3 hrs.
CS 540	Implementation of Adv. Algorithms	3 hrs.
CS 541	Software Engineering	3 hrs.
CS 543	Scientific Computation	3 hrs.
CS 545	Network and Telecom I	3 hrs.
CS 546	Network and Telecom II	3 hrs.

CS 547	Algorithms for Parallel Computers	3 hrs.
CS 553	Information Retrieval System II	3 hrs.
CS 555	Object-Oriented Programming and Data Structure	3 hrs.
CS 560	Special Topics I in Computer Science	3 hrs.
	TOTAL	**33 hrs.**

Computer Science Course Descriptions (CS)

CS 521 – THEORY OF COMPUTATION
(3 Credits)
Introducing fundamental ideas, models, and languages that permeate computer science. Describing certain restricted models of computation. Studying general computer models (Finite Automata, Regular Languages and Regular Grammars, Context-Free Languages, Simplification of Context-Free Grammars and Normal Forms, Pushdown Automat, Turing Machine) and their applications.
Pre-requisite: None.

CS 523 – PROGRAMMING LANGUAGES
(3 Credits)
This course surveys the concepts, features, and history of a variety of programming languages. Main topics include data and procedural abstraction, programming paradigms, and formal semantics. Popular programming languages are studied and compared feature by feature. Scholarly research is required in this course.
Prerequisite: CS 321 or equivalent.

CS 525 – OPERATING SYSTEMS
(3 Credits)
This course examines the important problems in operating system design and implementation. The operating system provides an established, convenient, and efficient interface between user programs and the bare hardware of the computer on which they run. The operating system is responsible for sharing resources (e.g., disks, networks, and processors), providing common services needed by many different programs (e.g., file service, the ability to start or stop processes, and access to the printer), and protecting individual programs from interfering with one another. Particular emphasis will be given to three major OS subsystems: process management (processes, threads, CPU scheduling, synchronization, and deadlock), memory management (segmentation, paging, swapping), and file systems; and on operating system support for distributed systems.
Pre-requisite: CS 321 or equivalent.

CS 527 – DESIGN AND ANALYSIS OF ALGORITHMS
(3 Credits)
Techniques of designing and analyzing algorithms. Divide-and-conquer methods, greedy algorithms, dynamic programming, backtracking, branch-and-bound techniques, amortized analysis, Computational Complexity Classes, NP-hard and NP-complete problems, and heuristics. Cook‘s Theorem.
Pre-requisite: CS 321, MA 304.

CS 529 – INFORMATION RETRIEVAL SYSTEM I
(3 Credits)
This course introduces the theories and algorithms of advanced information retrieval systems. The course provides an overall picture of the information retrieval system as well as detailed implementation of the subsystems. Topics include automatic indexing, query formulation, output ranking, and the design and evaluation of information retrieval systems.
Prerequisites: CS321 or equivalent.

CS 531 – ARTIFICIAL INTELLIGENCE
(3 Credits)
Definition of heuristic versus algorithmic methods. Special purpose programming languages; knowledge representation; automated inference; expert systems; machine learning; and neural computation.
Pre-requisite: CS 321 or equivalent.

CS 533 – DATABASE MANAGEMENT SYSTEMS
(3 Credits)
Relational and other data models, data independence, relational algebra and calculus, SQL, normal forms and normalization, semantic modeling and ER diagrams.
Pre-requisite: None.

CS 535 – COMPUTER ARCHITECTURE
(3 Credits)
This course is designed to introduce students the basics of computer architecture and organization. It will cover the following aspects: number representations, digital logic (Boolean algebra, the gates of digital logic circuits, combinational circuit), computer systems and functions, cache memory, internal memory, external memory, input/output modules and interrupt, system buses. If time is permitted, processor structure, RISC and parallel processing will also be discussed.
Pre-requisite: None.

CS 537 – COMPUTER GRAPHICS
(3 Credits)
Assuming no background in computer graphics, this graduate-level course presents basic principles for the design, use, and understanding of computer graphics systems and applications. Updated throughout for the latest developments and technologies, this course combines the principles and major techniques in computer graphics with state-of-the-art examples that relate to things students see every day on the Internet and in computer-generated movies. Practical, accessible, and integrated in approach, it carefully presents each concept, explains the underlying mathematics, shows how to translate the math into program code, and displays the result.
Pre-requisite: None.

CS 539 – COMPILER CONSTRUCTION
(3 Credits)
Formal description of languages, lexical analysis, syntax analysis, syntax-directed translation, run-time system management, code generation, code optimization, compiler-building tools.
Pre-requisite: CS 525.

CS 540 – IMPLEMENTATION OF ADVANCED ALGORITHMS
(3 Credits)
This is a course on more complex data structures, and algorithm design and analysis. Topics include: asymptotic complexity analysis; standard algorithm design techniques; graph algorithms; sorting algorithms; and other "classic" algorithms that serve as examples of design techniques.
Pre-requisite: None.

CS 541 – SOFTWARE ENGINEERING
(3 Credits)
Concept of software and software engineering, software engineering modeling, requirements, architectural design, user interface design, software quality management, software programming, software testing strategies, software verification and validation, the trend of the future of software engineering.
Pre-requisite: None.

CS 543 – SCIENTIFIC COMPUTATION
(3 Credits)
Study of numerical algorithms, Mathematical models, their implementations in C++, MATLAB, implementation on parallel machines, application of these methods in Science and Engineering problems.
Pre-requisite: CS 321 or equivalent, good Mathematics background.

CS 545 – NETWORK AND TELECOM I
(3 Credits)
This course introduces a broad overview of computer networking and the Internet (terminology and concepts), conceptual and implementation aspects of network applications, relationship between the transport and network layers,

controlling the transmission rate of transport layer entities, causes and consequences of congestion, as well as commonly used congestion-control techniques, TCP's approach to congestion control, and exactly how the network layer implements the host-to-host communication service.
Prerequisite: MA 181 and CS 480 or any programming course or special permission from the instructor.

CS 546 – NETWORK AND TELECOM II
(3 Credits)
This course introduces exactly how the network layer implements the host-to-host communication service, explore several important link-layer concepts, dive deeper into error detection and correction (a topic touched on briefly in CS 440 or CS 545), mobile users, wireless links, networks, and their relationship to the larger (typically wired) networks to which they connect. How multimedia applications, multimedia application can be classified as streaming stored audio/video, conversational voice/video-over-IP, or streaming live audio/video.
Pre-requisite: CS 440 or CS 545.

CS 547 – ALGORITHMS FOR PARALLEL COMPUTERS
(3 Credits)
Advanced computer architectures, parallel and distributed computing, parallel algorithms and their implementation, scientific problems which need high performance computation. Pre-requisite: CS 527 or Permission of Instructor.

CS 553 – INFORMATION RETRIEVAL SYSTEM II
(3 Credits)
Development of a sample information retrieval system. Practice design and development of a complete system. Topics include indexing, database, file processing, and user interface design. Pre-requisite: CS 321 or equivalent.

CS 555 – OBJECT-ORIENTED PROGRAMMING AND DATA STRUCTURE
(3 Credits)
This course focuses on the object oriented programming and data structure. It is geared toward non-CS majors going into computer and information science graduate program. The course will cover key concepts of data structures, data manipulation, algorithms and efficiency. Topics include: data structures (arrays, lists, stacks, queues, trees, and graphs), classes, interfaces, inheritance and polymorphism. Software projects will be implemented in this course to enhance students' hands-on programming skills and problem-solving abilities.
Pre-requisite: None.

CS 560 – SPECIAL TOPICS IN COMPUTER SCIENCE
(3 Credits)
A course for CS major graduate students to investigate a computer science topic that is not included in the curriculum. The course is under the supervision of a faculty member.
Pre-requisite: None.

CS 561 – SPECIAL TOPICS II IN COMPUTER SCIENCE
(3 Credits)
This course focuses on academic reading/writing, project and/or thesis composition.
Pre-requisite: None.

CS 580 – RESEARCH PROJECT
(3 Credits)
Individual investigation of a project related to the computer science discipline. The course is under the supervision of a faculty member.
Not for students who are taking or have taken CS 581 or CS 590.

CS 581 – INTERNSHIP
(3 Credits)
Individual investigation of a project related to the computer science discipline. Students must take training positions (co-operative/curricular practical training/ field practice) in an agency, which provide students with working experience in computer science under supervision of the faculty and agencies.
Not for students who are taking or have taken CS 580 or CS 590.

CS 590 – THESIS
(6 Credits)
Directed research on a selected topic with the consent of the graduate adviser. The course is under the supervision of a faculty member.
Not for students who are taking CS 580 or CS 581.

ENDORSEMENT AREA: MATHEMATICS EDUCATION

Degree Offered	**Requirement for Admission**
Secondary Education Masters: Mathematics	Standard Educator License

Program Description

The Master of Science in Education degree in Secondary Education (with an endorsement in mathematics) is interdisciplinary. It is designed for mathematics teachers in elementary, junior and senior high schools, and junior colleges. Specifically, the department strives to:

1. strengthen the attributes of a good teacher;
2. develop skill in oral and written communication of mathematics;
3. Establish an intellectual environment in which teaching and learning flourish together.

Course Requirements

Core Education Courses (12 hours)		**Credits**
ED 512	Foundations of American Research	3 hrs.
ED 514	Methods of Educational Research	3 hrs.
ED 533	Curriculum (Methods) Development	3 hrs.
PH 513	Advanced Educational Psychology	3 hrs.

Required Courses (18 hours)		**Credits**
MA 501	Introduction to Analysis	3 hrs.
MA 502	Logic, Sets and Found. of Math	3 hrs.
MA 503	Abstract Algebra I	3 hrs.
MA 504	Axiomatic Geometry	3 hrs.
MA 515	General Topology	3 hrs.
MA 585	Methods of Teaching Mathematics	3 hrs.

Electives (at least one course in algebra) (3-6 hours)		**Credits**
MA 511	Introduction to Analysis II	3 hrs.
MA 512	Complex Variables	3 hrs.
MA 513	Abstract Algebra II	3 hrs.
MA 514	Synthetic Projective Geometry	3 hrs.
MA 516	Group Theory	3 hrs.
MA 560	Modern Topics in Mathematics	1-3 hrs.
	TOTAL	**33 hrs.**

Mathematics Course Descriptions (MA)

MA 501 – INTRODUCTION TO ANALYSIS I
(3 Credits)
Point set theory, sequences, continuity, uniform continuity, and properties of continuous functions, limits. Riemann integration.

MA 502 – LOGIC, SETS, AND FOUNDATIONS OF MATHEMATICS
(3 Credits)
This course serves as an introduction to the foundations of mathematics and includes study of functions, relations, partially ordered sets the axiom of choice, finite and infinite sets.

MA 503 – ABSTRACT ALGEBRA I
(3 Credits)
Fundamental Theorems of homomorphism and isomorphism for group, class equation, Sylow Theorems, Structure of finite abelian groups.

MA 504 – AXIOMATIC GEOMETRY
(3 Credits)
A rigorous introduction to the axiomatic structure of Euclidean and non-Euclidean geometry.

MA 511 – INTRODUCTION TO ANALYSIS II
(3 Credits)
Taylor's Theorem, improper integrals, infinite series, uniform convergence, directional derivatives, partial derivatives.

MA 512 – COMPLEX VARIABLES
(3 Credits)
Rigorous introduction to the theory of complex variables.

MA 513 – ABSTRACT ALGEBRA II
(3 Credits)
Rings, ideals, integral domains. Quotient Rings, prime and maximal Ideals, Fundamental Theorem of Homomorphism and Isomorphism. Quotient field, field, finite field, division ring. Field extensions: finite, infinite and algebraic.

MA 514 – SYNTHETIC PROJECTIVE GEOMETRY
(3 Credits)
Elementary treatment, without the use of coordinates, of fundamental propositions of projective geometry.

MA 515 – GENERAL TOPOLOGY
(3 Credits)
Set theory, metric spaces, topological spaces, limits, continuity, connectedness, compactness, and convergence.

MA 516 – LINEAR ALGEBRA
(3 Credits)
Linear transformation of vector spaces. Inner product space, normed linear space, Grahm-Scmidt orthogonalization process, diagonalization.

MA 560 – MODERN TOPICS IN MATHEMATICS
(3 Credits)
A study of modern topics taken from the literature and current research.

MA 561 – DISCRETE MATHEMATICS FOR SECONDARY TEACHERS
(3 Credits)
Discrete mathematics is the total in science of mathematics connections, provides a setting for problem solving with real world applications, capitalizing on technological setting, and fosters critical thinking and mathematical reasoning.

MA 570 – THESIS
(3 Credits)
This course will require the student to initiate and carry to completion a research project under the supervision of a faculty member.

MA 585 – MODERN METHODS OF TEACHING
(3 Credits)
A methods course taught by faculty from the various areas of endorsement in secondary education.