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Course:

CMSC

Section:

Term: Fall 2025



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☐ Open Sections Only

Credit:

Level: ☒ All ☐ Undergraduate ☐ Graduate

Instructor(last,first):

Delivery: ☐ Face-to-Face ☐ Blended Learning ☐ Online

Start Time: :

Location/Program:



Course Days: ☐ Monday ☐ Tuesday ☐ Wednesday ☐ Thursday ☐ Friday

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Courses - Fall 2025



CMSC



QUESTIONS? ASK SHELLY

Computer Science [Department Site](#)[Show All Sections](#)

CMSC100

Bits and Bytes of Computer and Information Sciences

[Syllabus Repository \(0\)](#)

Credits: 1

Grad.Meth: Reg

Restriction: For first time freshmen and first time transfer students; or permission of CMNS-Computer Science department.**Cross-listed with:** INST101.**Credit only granted for:** CMSC100 or INST101.

Students are introduced to the fields (and disciplines) of computer science and information science within a small classroom setting. They will learn to make a successful transition from high school to the university, while exploring study skills, student success plans and research opportunities.

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CMSC106

Introduction to C Programming

[Syllabus Repository \(0\)](#)

Credits: 4

Grad.Meth: Reg

Prerequisite: MATH115.**Restriction:** Must not be in Computer Science program; and must not have completed any courses from CMSC131-499 course range.**Credit only granted for:** CMSC106 or CMSC122.

Design and analysis of programs in C. An introduction to computing using structured programming concepts. Intended for students with no or minimal programming experience.

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CMSC122

Introduction to Computer Programming via the Web

[Syllabus Repository \(0\)](#)

Credits: 3

Grad.Meth: Reg

GenEd: [DSSP](#)

Restriction: Must not have completed any courses from CMSC131-499 course range; and must not be concurrently enrolled in CMSC131.

Credit only granted for: CMSC106, or CMSC122.

Introduction to computer programming in the context of developing full featured dynamic web sites. Uses a problem solving approach to teach basics of program design and implementation using JavaScript; relates these skills to creation of dynamic web sites; then explores both the potential and limits of web-based information sources for use in research. Intended to help relate a student's major to these emerging technologies.

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CMSC125

Introduction to Computing

[Syllabus Repository \(1\)](#)



Credits: 3

Grad Meth: Reg

GenEd: [DSSP](#)

Prerequisite: Must have completed or be concurrently enrolled in MATH115 or higher.

Restriction: Must not be in the Computer Science program; and must not have completed any courses from CMSC131-499; and must not have completed BMGT302, IMDM127 or INST126.

Credit only granted for: IMDM127 or CMSC125.

Introduces you to the computing field as a whole. You will gain skills used across the spectrum of computing majors and learn about the great variety of routes into the various areas of study and employment in technological fields.

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CMSC131

Object-Oriented Programming I

[Syllabus Repository \(1\)](#)



Credits: 4

Grad Meth: Reg

Corequisite: MATH140.

Credit only granted for: CMSC131, CMSC133 or CMSC141.

Introduction to programming and computer science. Emphasizes understanding and implementation of applications using object-oriented techniques. Develops skills such as program design and testing as well as implementation of programs using a graphical IDE. Programming done in Java.

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CMSC132

Object-Oriented Programming II



[Syllabus Repository_\(0\)](#)

Credits: 4

~~Grad Meth:~~ Reg

Prerequisite: Minimum grade of C- in CMSC131; or must have earned a score of 5 on the A Java AP exam; or must have earned a satisfactory score on the departmental placement exam; and minimum grade of C- in MATH140.

Credit only granted for: CMSC132 or CMSC142.

Introduction to use of computers to solve problems using software engineering principles. Design, build, test, and debug medium -size software systems and learn to use relevant tools. Use object-oriented methods to create effective and efficient problem solutions. Use and implement application programming interfaces (APIs). Programming done in Java.

[Show Sections All Sections Face-to-Face](#) [Blended Learning](#) [Online](#)

CMSC133

(Perm Req)

Object Oriented Programming I Beyond Fundamentals

[Syllabus Repository_\(0\)](#)

Credits: 2

~~Grad Meth:~~ Reg

Prerequisite: Must have completed or be concurrently enrolled in MATH140.

Restriction: Permission of CMNS-Computer Science department; and student must have earned a 4 on the AP Computer Science A exam or a satisfactory score on the CMSC131 department placement exam.

Credit only granted for: CMSC131 or CMSC133.

An introduction to computer science and object-oriented programming for students with prior Java programming knowledge (conditionals, loops, methods). Program design, implementation, and testing using object-oriented techniques. All programming will be done in Java using a graphical IDE.

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CMSC216

(Perm Req)

Introduction to Computer Systems

[Syllabus Repository_\(0\)](#)

Credits: 4

~~Grad Meth:~~ Reg

Prerequisite: Minimum grade of C- in CMSC132; and minimum grade of C- in MATH141.



Restriction: Must be in a major within the CMNS-Computer Science department; or must be in Engineering: Computer program; or must be in the Computer Science Minor program; and Permission of CMSC - Computer Science department.

Introduction to the interaction between user programs and the operating system/hardware. Major topics include C programming, introductory systems programming, and assembly language. Other concepts covered include UNIX, machine data representation, thread management, optimization, and virtual memory. Programming is done in the Linux Environment.

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CMSC250

(Perm Req)

Discrete Structures

[Syllabus Repository \(1\)](#)



Credits: 4

Grad Meth: Reg

Prerequisite: Minimum grade of C- in CMSC131; and minimum grade of C- in MATH141.

Restriction: Must be in a major within the CMNS-Computer Science department; or must be in Engineering: Computer program; or must be in the Computer Science Minor program; and Permissions of CMSC - Computer Science department.

Fundamental mathematical concepts related to computer science, including finite and infinite sets, relations, functions, and propositional logic.

Introduction to other techniques, modeling and solving problems in computer science. Introduction to permutations, combinations, graphs, and trees with selected applications.

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CMSC298A

(Perm Req)

Special Topics in Computer Science

[Syllabus Repository \(1\)](#)



Credits: 1 - 4

Grad Meth: S-F

Contact department for information to register for this course.

CMSC320

(Perm Req)

Introduction to Data Science

[Syllabus Repository \(0\)](#)



Credits: 3

~~Grad Meth: Reg~~

Prerequisite: Minimum grade of C- in CMSC216 and CMSC250.

Restriction: Permission of CMNS-Computer Science department.

Credit only granted for: CMSC320, DATA320 or STAT426.

An introduction to the data science pipeline, i.e., the end-to-end process of going from unstructured, messy data to knowledge and actionable insights. Provides a broad overview of several topics including statistical data analysis, basic data mining and machine learning algorithms, large-scale data management, cloud computing, and information visualization.

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CMSC330

(Perm Req)

Organization of Programming Languages

[Syllabus Repository_\(0\)](#)





Credits: 3

~~Grad Meth: Reg~~

Prerequisite: Minimum grade of C- in CMSC250 and CMSC216.

Restriction: Must be in a major within the CMNS-Computer Science department; or must be in the Computer Science Minor program; or must be in Engineering: Computer program; and Permission of CMSC - Computer Science department.

A study of programming languages, including their syntax, semantics, and implementation. Several different models of languages are discussed, including dynamic, scripting (e.g., Ruby, Python) functional (e.g., OCaml, Haskell, Scheme), and memory safe systems programming (e.g., Rust). Explores language features such as formal syntax, scoping and binding of variables, higher-order programming, typing, and type polymorphism. Introduces finite automata, context free grammar, parsing, lambda calculus, and basics of security attacks and software security.

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CMSC335

(Perm Req)

Web Application Development with JavaScript

[Syllabus Repository_\(0\)](#)



Credits: 3

~~Grad Meth: Reg~~

Prerequisite: Minimum grade of C- in CMSC216 and CMSC250.

Restriction: Permission of CMNS-Computer Science Department.

Credit only granted for: CMSC389N or CMSC335.

Formerly: CMSC389N.



Provides an introduction to modern ways of developing Web Applications/Services using JavaScript for both front-end and back-end. The course covers topics on fundamental JavaScript language constructs, server-side JavaScript, back-end data persistence, and client-side JavaScript to build Web Applications that interact with Web services and back-end databases.

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CMSC351

(Perm Req)

Algorithms

[Syllabus Repository_\(1\)](#)



Credits: 3

Grad Meth: Reg

Prerequisite: Minimum grade of C- in CMSC250 and CMSC216.

Restriction: Must be in a major within the CMNS-Computer Science department; or must be in Engineering: Computer program; or must be in the Computer Science Minor program; and Permission from the CMSC - Computer Science department.

A systematic study of the complexity of some elementary algorithms related to sorting, graphs and trees, and combinatorics. Algorithms are analyzed using mathematical techniques to solve recurrences and summations.

[Show Sections All Sections Face-to-Face](#)  [Blended Learning](#)  [Online](#)

CMSC396H

(Perm Req)

Computer Science Honors Seminar

[Syllabus Repository_\(0\)](#)



Credits: 1

Grad Meth: Reg

Prerequisite: Must have admission into Computer Science Departmental Honors Program.

Restriction: Permission of CMNS-Computer Science department.

Overview of computer science research activities, techniques, and tools. Diverse research areas will be covered, including systems, networks, artificial intelligence, human-computer interaction, software engineering, graphics, vision, and theory.

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CMSC411

(Perm Req)

Computer Systems Architecture

[Syllabus Repository_\(0\)](#)





Credits: 3

Grad Meth: Reg

Prerequisite: Minimum grade of C- in CMSC330; or must be in the (Computer Science (Doctoral), Computer Science (Master's)) program.

Restriction: Permission of CMNS-Computer Science department.

Credit only granted for: ENEE446 or CMSC411.

Input/output processors and techniques. Intra-system communication, buses, caches. Addressing and memory hierarchies. Microprogramming, parallelism, and pipelining.

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CMSC412

(Perm Req)

Operating Systems

[Syllabus Repository_\(0\)](#)



Credits: 4

Grad Meth: Reg

Prerequisite: Minimum grade of C- in CMSC330 and CMSC351; and 1 course with a minimum grade of C- from (CMSC414, CMSC417, CMSC420, CMSC430, CMSC433, CMSC435, ENEE440, ENEE457).

Restriction: Permission of CMNS-Computer Science department; or must be in one of the following programs (Computer Science (Master's); Computer Science (Doctoral)).

Credit only granted for: CMSC412 or ENEE447.

A hands-on introduction to operating systems, including topics in: multiprogramming, communication and synchronization, memory management, IO subsystems, and resource scheduling policies. The laboratory component consists of constructing a small kernel, including functions for device IO, multi-tasking, and memory management.

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CMSC414

(Perm Req)


Computer and Network Security

[Syllabus Repository_\(6\)](#)



Credits: 3

Grad Meth: Reg

Prerequisite: Minimum grade of C- in CMSC330 and CMSC351; or must be in the (Computer Science (Doctor:  Computer Science (Master's)) program.

Restriction: Permission of CMNS-Computer Science department.

Credit only granted for: CMSC414, ENEE459C, or ENEE457.

An introduction to the topic of security in the context of computer systems and networks. Identify, analyze, and solve network-related security problems in computer systems. Fundamentals of number theory, authentication, and encryption technologies, as well as the practical problems that have to be solved in order to make those technologies workable in a networked environment, particularly in the wide-area Internet environment.

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CMSC416

(Perm Req)

Introduction to Parallel Computing

[Syllabus Repository \(0\)](#)



Credits: 3

Grad Meth: Reg

Prerequisite: Minimum grade of C- in CMSC330 and CMSC351; or permission of instructor.

Restriction: Permission of CMNS-Computer Science department.

Jointly offered with: CMSC616.

Credit only granted for: CMSC416, CMSC498X, CMSC616, or CMSC818X.

Formerly: CMSC498X.

Introduction to parallel computing. Topics include programming for shared memory and distributed memory parallel architectures, and fundamental issues in design, development, and performance analysis of parallel programs.

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CMSC417

(Perm Req)

Computer Networks

[Syllabus Repository \(3\)](#)



Credits: 3

Grad Meth: Reg

Prerequisite: Minimum grade of C- in CMSC351 and CMSC330; and permission of CMNS-Computer Science department. Or must be in the (Computer Science (Doctoral), Computer Science (Master's)) program.

Computer networks and architectures. The OSI model including discussion and examples of various network layers. A general introduction to existing network protocols. Communication protocol specification, analysis, and testing.

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CMSC420

(Perm Req)



Advanced Data Structures

[Syllabus Repository \(1\)](#)

Credits: 3

Grad.Meth: Reg

Prerequisite: Minimum grade of C- in CMSC351 and CMSC330; and permission of CMNS-Computer Science department. Or must be in the (Computer Science (Doctoral), Computer Science (Master's)) program.

Description, properties, and storage allocation functions of data structures including balanced binary trees, B-Trees, hash tables, skiplists, tries, KD-Trees and Quadrees. Algorithms for manipulating structures. Applications from areas such as String Processing, Computer Graphics, Information Retrieval, Computer Networks, Computer Vision, and Operating Systems.

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CMSC421

(Perm Req)

Introduction to Artificial Intelligence

[Syllabus Repository \(2\)](#)

Credits: 3

Grad.Meth: Reg

Prerequisite: Minimum grade of C- in CMSC351 and CMSC330; and permission of CMNS-Computer Science department. Or must be in the (Computer Science (Doctoral), Computer Science (Master's)) program.

Introduces a range of ideas and methods in AI, varying semester to semester but chosen largely from: automated heuristic search, planning, games, knowledge representation, logical and statistical inference, learning, natural language processing, vision, robotics, cognitive modeling, and intelligent agents. Programming projects will help students obtain a hands-on feel for various topics.

[Show Sections All Sections](#) [Face-to-Face](#)  [Blended Learning](#)  [Online](#)

CMSC422

(Perm Req)

Introduction to Machine Learning

[Syllabus Repository \(0\)](#)

Credits: 3

Grad.Meth: Reg

Prerequisite: Minimum grade of C- in CMSC320, CMSC330, and CMSC351; and 1 course with a minimum gr:  of C- from (MATH240, MATH341, MATH461); and permission of CMNS-Computer Science department.

Machine Learning studies representations and algorithms that allow machines to improve their performance on a task from experience. This is a broad overview of existing methods for machine learning and an introduction to adaptive systems in general. Emphasis is given to practical aspects of machine learning and data mining.

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CMSC423

(Perm Req)

Bioinformatic Algorithms, Databases, and Tools

[Syllabus Repository \(1\)](#)



Credits: 3

~~Grad Meth: Reg~~

Prerequisite: Minimum grade of C- in CMSC351 and CMSC330; and permission of CMNS-Computer Science department. Or must be in the (Computer Science (Doctoral), Computer Science (Master's)) program.

An introduction to the main algorithms, databases, and tools used in bioinformatics. Topics may include assembly and analysis of genome sequences, reconstructing evolutionary histories, predicting protein structure, and clustering of biological data. Use of scripting languages to perform analysis tasks on biological data. No prior knowledge of biology is assumed.

[Show Sections All Sections Face-to-Face](#)  [Blended Learning](#)  [Online](#)

CMSC424

(Perm Req)

Database Design

[Syllabus Repository \(1\)](#)



Credits: 3

~~Grad Meth: Reg~~

Prerequisite: Minimum grade of C- in CMSC351 and CMSC330; and permission of CMNS-Computer Science department. Or must be in the (Computer Science (Doctoral), Computer Science (Master's)) program.

Students are introduced to database systems and motivates the database approach as a mechanism for modeling the real world. An in-depth coverage of the relational model, logical database design, query languages, and other database concepts including query optimization, concurrency control; transaction management, and log based crash recovery. Distributed and Web database architectures are also discussed.

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CMSC425

(Perm Req)

Game Programming



[Syllabus Repository \(0\)](#)

Credits: 3

Grad.Meth: Reg

Prerequisite: Minimum grade of C- in CMSC330 and CMSC351.**Restriction:** Permission of CMNS-Computer Science department.

An introduction to the principles and practice of computer game programming and design. This includes an introduction to game hardware and systems, the principles of game design, object and terrain modeling, game physics, artificial intelligence for games, networking for games, rendering and animation, and aural rendering. Course topics are reinforced through the design and implementation of a working computer game.

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CMSC426

(Perm Req)

Computer Vision

[Syllabus Repository \(0\)](#)

Credits: 3

Grad.Meth: Reg

Prerequisite: Minimum grade of C- in CMSC330 and CMSC351 and 1 course with a minimum grade of C- from (MATH240, MATH341, MATH461); or must be in the (Computer Science (Doctoral), Computer Science (Master's)) program; or permission of the instructor.**Restriction:** Permission of CMNS-Computer Science department.

An introduction to basic concepts and techniques in computervision. This includes low-level operations such as image filtering and edge detection, 3D reconstruction of scenes using stereo and structure from motion, and object detection, recognition and classification.

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CMSC430

(Perm Req)

Introduction to Compilers

[Syllabus Repository \(0\)](#)

Credits: 3

Grad.Meth: Reg

Prerequisite: Minimum grade of C- in CMSC330 and CMSC351; and permission of CMNS-Computer Science department. Or must be in the (Computer Science (Doctoral), Computer Science (Master's)) program.

Topics include lexical analysis, parsing, intermediate representations, program analysis, optimization, and code generation.



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CMSC433

(Perm Req)

Programming Language Technologies and Paradigms

[Syllabus Repository_\(0\)](#)





Credits: 3

Grad Meth: Reg

Prerequisite: Minimum grade of C- in CMSC330; or must be in the (Computer Science (Doctoral), Computer Science (Master's)) program.

Restriction: Permission of CMNS-Computer Science department.

Programming language technologies (e.g., object-oriented programming), their implementations and use in software design and implementation.

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CMSC434

(Perm Req)

Introduction to Human-Computer Interaction

[Syllabus Repository_\(4\)](#)



Credits: 3

Grad Meth: Reg

Prerequisite: Minimum grade of C- in CMSC330 and CMSC351; and permission of CMNS-Computer Science department. Or must be in the (Computer Science (Doctoral), Computer Science (Master's)) program.

Assess usability by quantitative and qualitative methods. Conduct task analyses, usability tests, expert reviews, and continuing assessments of working products by interviews, surveys, and logging. Apply design processes and guidelines to develop professional quality user interfaces. Build low-fidelity paper mockups, and a high-fidelity prototype using contemporary tools such as graphic editors and a graphical programming environment (eg: Visual Basic, Java).

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CMSC435

(Perm Req)

Software Engineering

[Syllabus Repository_\(0\)](#)



Credits: 3

Grad Meth: Reg



Prerequisite: 1 course with a minimum grade of C- from (CMSC412, CMSC417, CMSC420, CMSC430, CMSC433, ENEE447); and permission of CMNS-Computer Science department.

State-of-the-art techniques in software design and development. Laboratory experience in applying the techniques covered. Structured design, structured programming, top-down design and development, segmentation and modularization techniques, iterative enhancement, design and code inspection techniques, correctness, and chief-programmer teams. The development of a large software project.

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CMSC436

(Perm Req)

Programming Handheld Systems

[Syllabus Repository_\(0\)](#)



Credits: 3

Grad Meth: Reg

Prerequisite: Minimum grade of C- in CMSC330 and CMSC351; or must be in the (Computer Science (Doctoral), Computer Science (Master's)) program.

Restriction: Permission of CMNS-Computer Science department.

Fundamental principles and concepts that underlie the programming of handheld systems, such as mobile phones, personal digital assistants, and tablet computers. Particular emphasis will be placed on concepts such as limited display size, power, memory and CPU speed; and new input modalities, where handheld systems differ substantially from non-handheld systems, and thus require special programming tools and approaches. Students will apply these concepts and principles in the context of an existing handset programming platform.

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CMSC451

(Perm Req)

Design and Analysis of Computer Algorithms

[Syllabus Repository_\(1\)](#)



Credits: 3

Grad Meth: Reg

Prerequisite: Minimum grade of C- in CMSC351; and permission of CMNS-Computer Science department. Or must be in the (Computer Science (Doctoral), Computer Science (Master's)) program.

Fundamental techniques for designing efficient computer algorithms, proving their correctness, and analyzing their complexity. General topics include graph algorithms, basic algorithm design paradigms (such as greedy algorithms, divide-and-conquer, and dynamic programming), network flows, NP-completeness, and other selected topics in algorithms.

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CMSC454

(Perm Req)

Algorithms for Data Science

[Syllabus Repository \(0\)](#)

Credits: 3

Grad Meth: Reg

Prerequisite: Minimum grade of C- in CMSC330 and CMSC351.**Restriction:** Permission of CMSC-Computer Science department.

Fundamental methods for processing a high volume of data. Methods include stream processing, locally sensitive hashing, web search methods, page rank computation, network and link analysis, dynamic graph algorithms as well as methods to handle high dimensional data/dimensionality reduction.

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CMSC456

(Perm Req)

Cryptography

[Syllabus Repository \(1\)](#)



Credits: 3

Grad Meth: Reg

Prerequisite: (CMSC106, CMSC131, or ENEE150; or equivalent programming experience); and (2 courses from (CMSC330, CMSC351, ENEE324, or ENEE380); or any one of these courses and a 400-level MATH course, or two 400-level MATH courses); and Permission of CMNS-Mathematics department or permission of instructor .

Cross-listed with: MATH456, ENEE456.**Credit only granted for:** MATH456, CMSC456 or ENEE456.

The theory, application, and implementation of mathematical techniques used to secure modern communications. Topics include symmetric and public-key encryption, message integrity, hash functions, block-cipher design and analysis, number theory, and digital signatures.

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CMSC460

(Perm Req)

Computational Methods

[Syllabus Repository \(2\)](#)

Credits: 3

Grad Meth: Reg



Prerequisite: 1 course with a minimum grade of C- from (MATH240, MATH341, MATH461); and 1 course with a minimum grade of C- from (MATH241, MATH340); and 1 course with a minimum grade of C- from (CMSC106, CMSC131); and minimum grade of C- in MATH246.

Cross-listed with: AMSC460.

Credit only granted for: AMSC460, AMSC466, CMSC460, or CMSC466.

Basic computational methods for interpolation, least squares, approximation, numerical quadrature, numerical solution of polynomial and transcendental equations, systems of linear equations and initial value problems for ordinary differential equations. Emphasis on methods and their computational properties rather than their analytic aspects. Intended primarily for students in the physical and engineering sciences.

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CMSC466

(Perm Req)

Introduction to Numerical Analysis I

[Syllabus Repository_\(0\)](#)



Credits: 3

Grad Meth: Reg

Prerequisite: 1 course with a minimum grade of C- from (CMSC106, CMSC131); and minimum grade of C- in MATH410.

Cross-listed with: AMSC466.

Credit only granted for: AMSC460, CMSC460, AMSC466, or CMSC466.

Floating point computations, direct methods for linear systems, interpolation, solution of nonlinear equations.

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CMSC470

(Perm Req)

Introduction to Natural Language Processing

[Syllabus Repository_\(0\)](#)



Credits: 3

Grad Meth: Reg

Prerequisite: Minimum grade of C- in CMSC320, CMSC330, and CMSC351; and 1 course with a minimum grade of C- from (MATH240, MATH341, MATH461).

Restriction: Permission of CMNS-Computer Science department.

Introduction to fundamental techniques for automatically processing and generating natural language with computers. Machine learning techniques, models, and algorithms that enable computers to deal with the ambiguity and implicit structure of natural language. Application of these techniques in a series of assignments designed to address a core application such as question answering or machine translation.

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CMSC471

(Perm Req)

Introduction to Data Visualization

[Syllabus Repository \(1\)](#)

Credits: 3

Grad Meth: Reg

Prerequisite: Minimum grade of C- in CMSC330 and CMSC351; and permission of CMNS-Computer Science Department.**Restriction:** Permission of the CMNS-Computer Science Department.**Credit only granted for:** CMSC471 or CMSC498O.**Formerly:** CMSC498O.

Datasets are becoming increasingly large and complex, requiring intuitive ways to explore and interpret them quickly and efficiently. In this case, a picture is worth a thousand words: visualizations enable us to transform data into images that are easier to understand and reason about, compared to raw numbers and raw text. Visualizations are critical tools in externalizing and organizing our knowledge and insights, whether to explore collected datasets to improve our understanding of the physical world, to assess and debug analysis/experimental workflows, or to present new and interesting results to diverse audiences. In this course we will study techniques and algorithms for creating effective visualizations based on principles from graphic design, perceptual psychology, and cognitive science. Students will learn how to design and build interactive visualizations for the web, using the D3.js (Data-Driven Documents) framework.

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CMSC473

(Perm Req)

Capstone in Machine Learning

[Syllabus Repository \(0\)](#)

Credits: 3

Grad Meth: Reg

Prerequisite: Minimum grade of C- or higher in CMSC421 or CMSC422.**Recommended:** Background or exposure to machine learning topics is strongly encouraged.**Restriction:** Permission of instructor and Permission of CMSC - Computer Science department.**Credit only granted for:** CMSC498P or CMSC473.**Formerly:** CMSC498P.

Additional information: Students will be paired with project advisors from the UMD faculty or alternatively, an industry advisor. Students are encouraged to plan for projects results that can be published at academic conferences or will impact academic research.

Semester-long project course in which each student will identify and carry out a project related to machine learning, with the goal of publishing a research paper or software tool.



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CMSC474

(Perm Req)

Introduction to Computational Game Theory

[Syllabus Repository_\(0\)](#)



Credits: 3

Grad Meth: Reg

Prerequisite: Minimum grade of C- in CMSC351 and CMSC330; and permission of CMNS-Computer Science department. Or must be in the (Computer Science (Doctoral), Computer Science (Master's)) program.

Credit only granted for: CMSC474, ECON414, GVPT390 or GVPT399A.

Game theory deals with interactions among agents (either human or computerized) whose objectives and preferences may differ from the objectives and preferences of the other agents. It will also provide a comprehensive introduction to game theory, concentrating on its computational aspects.

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CMSC475

(Perm Req)

Combinatorics and Graph Theory

[Syllabus Repository_\(1\)](#)



Credits: 3

Grad Meth: Reg

Prerequisite: 1 course with a minimum grade of C- from (MATH240, MATH341, MATH461); and 1 course with a minimum grade of C- from (MATH241, MATH340). And permission of CMNS-Computer Science department; or permission of CMNS-Mathematics department.

Cross-listed with MATH475 .

General enumeration methods, difference equations, generating functions. Elements of graph theory, matrix representations of graphs, applications of graph theory to transport networks, matching theory and graphical algorithms.

Credit only granted for MATH475 or CMSC475.

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CMSC498A

(Perm Req)

Selected Topics in Computer Science

[Syllabus Repository_\(0\)](#)



Credits: 1 - 3

~~Grad Meth: Reg~~

An individualized course designed to allow a student or students to pursue a selected topic not taught as a part of the regular course offerings under the supervision of a Computer Science faculty member. Credit according to work completed.

Contact department for information to register for this course.

CMSC498B

(Perm Req)

Selected Topics in Computer Science; Cloud Computing

[Syllabus Repository \(0\)](#)



Credits: 3

~~Grad Meth: Reg~~

Prerequisites: Minimum grade of C- in CMSC330 and CMSC351.

Explores several fundamental topics of cloud computing, including IaaS (e.g., Open Stack, Kubernetes), key big data platforms, and data center networking. The course combines group reading and discussion of influential publications in the field, lectures by the instructor, talks by invited speakers, and a large project. Students will be a part of an agile development team, with extensive experience with GitHub, agile tools, and various technologies. Each course project is solicited from open-source community and will be mentored by an industry leader and/or engineer, or a senior graduate student/postdoc.

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CMSC498J

(Perm Req)

Selected Topics in Computer Science; Human-Robot Interaction, Device Prototyping, and Embodied AI

[Syllabus Repository \(0\)](#)



Credits: 3

~~Grad Meth: Reg~~

Minimum grade of C- in CMSC330 and CMSC351; and permission of CMNS-Computer Science department. Or must be in the (Computer Science (Doctoral), Computer Science (Master's)) program.

This course is designed to introduce advanced undergraduates to human-robot interaction (HRI) and the recent developments in embodied AI, an emerging research area focused on the design and evaluation of interactions between humans and robotic technologies. Students will: (1) learn design principles for building, and research methods for evaluating, interactive robot systems through lectures, readings, and assignments; (2) read and discuss relevant literature to gain a solid understanding of various research topics in HRI; and (3) gain hands-on experience by prototyping a functional embodied AI robot that integrates the principles, methods, and knowledge acquired throughout the course.

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CMSC498K

(Perm Req)

Selected Topics in Computer Science; Introduction to Multimodal Deep Learning

[Syllabus Repository_\(0\)](#)



Credits: 3

Grad Meth: Reg

Prerequisites: Minimum grade of C- in CMSC320, CMSC330, and CMSC351; and 1 course with a minimum grade of C- from (MATH240, MATH341, MATH461); and permission of the CMNS-Computer Science department.

This course will provide a comprehensive introduction to the fundamental concepts of key modalities and algorithms for multimodal representation learning, alignment, and fusion. Students will learn key concepts, algorithms, and applications centered around multimodal deep learning while gaining hands-on experience with state-of-the-art models and emerging research trends.

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CMSC498Z

(Perm Req)

Selected Topics in Computer Science; Differentiable Programming

[Syllabus Repository_\(0\)](#)



Credits: 3

Grad Meth: Reg

Prerequisites: Minimum grade of C- in CMSC330 and CMSC351 and permission of the CMNS-Computer Science department. This course is an introduction to differentiable Programming, a new programming paradigm in which a numerical program can be differentiated through automatic differentiation, allowing gradient-based optimization of parameters in the program. It has broad applications in Computer Graphics, Computer Vision, Deep Learning, Quantum Computing, System Control, and many more. The course assumes a good working knowledge of linear algebra and differentiation.

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CMSC499A

(Perm Req)

Independent Undergraduate Research

[Syllabus Repository_\(0\)](#)



Credits: 1 - 3

Grad.Meth: Reg

Students are provided with an opportunity to participate in a computer science research project under the guidance of a faculty advisor. Format varies. Students and supervising faculty member will agree to a research plan which must be approved by the department. As part of each research plan, students should produce a final paper delineating their contribution to the field.

Contact department for information to register for this course.

CMSC616

Foundations of Parallel Computing

[Syllabus Repository_\(0\)](#)



Credits: 3

Grad.Meth: Reg

Prerequisite: CMSC411 and CMSC412; or permission of instructor.

Restriction: Must be in the Computer Science or Applied Mathematics and Scientific Computation master's or doctoral programs.

Credit only granted for: CMSC616 or CMSC818X.

Formerly: CMSC818X.

Covers the foundations of parallel computing. Topics include programming for shared memory and distributed memory parallel architectures, and fundamental issues in design, development and analysis of parallel programs.

[Show Sections All Sections Face-to-Face](#) [Blended Learning](#) [Online](#)

CMSC631

Program Analysis and Understanding

[Syllabus Repository_\(0\)](#)



Credits: 3

Grad.Meth: Reg

Prerequisite: CMSC330; or students who have taken courses with comparable content may contact the department; or permission of instructor.

Techniques for static analysis of source code and modern programming paradigms. Analysis techniques: data flow analysis, program dependence graphs, program slicing, abstract interpretation. The meaning of programs: denotational semantics, partial evaluation. Advanced treatment of abstraction mechanisms: polymorphic types, operation overloading, inheritance, object-oriented programming and ML-like programming languages.

[Show Sections All Sections Face-to-Face](#) [Blended Learning](#) [Online](#)

CMSC634

Empirical Research Methods for Computer Science

[Syllabus Repository_\(0\)](#)



Credits: 3

Grad Meth: Reg

Recommended: An introductory statistics class.**Restriction:** Must be in Computer Science (Master's) program; or must be in Computer Science (Doctoral) program; or permission of instructor.**Credit only granted for:** CMSC838G (Fall2005) or CMSC634.

A graduate-level introductory course on empirical research methods for computer scientists. Experimental techniques for evaluating software systems and processes, human performance using interfaces, programming environments, and software engineering methods. Introduction to constructs and methods of measurements, qualitative and quantitative design, quasi-experimental and non-experimental design, baseline design, and statistical analysis.

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CMSC657

Introduction to Quantum Information Processing

[Syllabus Repository_\(1\)](#)



Credits: 3

Grad Meth: Reg

Prerequisite: Familiarity with complex numbers and basic concepts in linear algebra (e.g., eigenvalues, eigenvectors, Hermitian and unitary matrices) is required.**Credit only granted for:** CMSC657 or CMSC858K.**Formerly:** CMSC858K.**Additional information:** Previous background in quantum mechanics or theory of computation is not required.

An introduction to the field of quantum information processing. Students will be prepared to pursue further study in quantum computing, quantum information theory, and related areas.

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CMSC660

Scientific Computing I

[Syllabus Repository_\(0\)](#)



Credits: 3

Grad Meth: Reg

Prerequisite: Must have knowledge of Matlab or Python.**Cross-listed with:** AMSC660.**Credit only granted for:** AMSC660 or CMSC660.

Fundamental techniques in scientific computation with an introduction to theory and software for each topic. Computer numbers and sources of errors, numerical linear algebra, optimization, and Monte Carlo methods.

[Show Sections](#) [All Sections](#) [Face-to-Face](#)  [Blended Learning](#)  [Online](#)

CMSC673

Capstone in Machine Learning

[Syllabus Repository_\(0\)](#)



Credits: 3

Grad Meth: Reg

Prerequisite: Minimum grade of C-in CMSC421 or CMSC422.

Jointly offered with: CMSC473.

Credit only granted for: CMSC673, CMSC798P, CMSC473, or CMSC498P.

Formerly: CMSC798P.

Semester-long project course in which each student will identify and carry out a project related to machine learning, with the goal of publishing a research paper or software tool.

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CMSC702

Algorithmic Evolutionary Biology

[Syllabus Repository_\(0\)](#)



Credits: 3

Grad Meth: Reg

Restriction: Restricted to Master's/Doctoral students in Computer Science, Electrical and Computer, Engineering, Mathematics, Bioengineering, or permission of instructor.

Credit only granted for: CMSC702 or CMSC829A.

Formerly: CMSC829A.

Covers fundamental computational problems from comparative genomics and evolutionary biology. Topics include multiple sequence alignment and the reconstruction of evolutionary histories (e.g., phylogenetic trees and networks). These tasks are typically framed as NP-hard optimization problems, motivating the development of heuristics based on constraints, graph algorithms, and more recently machine learning. We analyze algorithms from the empirical and theoretical perspectives (e.g., computational complexity, optimality guarantees, and statistical consistency under popular models of evolution). Lastly, we discuss how algorithms are leveraged in emerging applications, like evolutionary analyses of tumors and pathogens, along with their limitations and directions for future research.

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CMSC722

Artificial Intelligence Planning



[Syllabus Repository \(0\)](#)

Credits: 3

Grad Meth: Reg, Aud, S, F

Prerequisite: CMSC421; or students who have taken courses with comparable content may contact the department; or permission of CMNS-Computer Science department.

Automated planning of actions to accomplish some desired goals. Basic algorithms, important systems, and new directions in the field of artificial intelligence planning systems.

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CMSC723

Natural Language Processing

[Syllabus Repository \(0\)](#)

Credits: 3

Grad Meth: Reg

Prerequisite: Minimum grade of C- in CMSC422; and permission of CMNS-Computer Science department.**Cross-listed with:** INST735, LING723.**Credit only granted for:** CMSC723, LING723, or INST735.**Additional information:** CMSC students may only receive PhD Comp. credit for CMSC723 or CMSC823, not both.

Introduce fundamental concepts, techniques, and algorithms for the computational handling of natural language. Statistical and machine learning techniques, models, and algorithms that enable computers to deal with the ambiguity and implicit structure of human language. Approaches that focus on uncovering linguistic structure, such as syntactic or semantic parsing, as well as those that focus on manipulating text in useful ways, such as question answering or machine translation.

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CMSC740

Advanced Computer Graphics

[Syllabus Repository \(0\)](#)

Credits: 3

Grad Meth: Reg

Prerequisite: MATH240 and CMSC420; or permission of instructor.An introduction to advanced concepts in computer graphics. Includes an introduction to realistic rendering based  physical properties of light transport, radiometric concepts, and the rendering equation; Monte Carlo integration techniques to solve the rendering equation such as path tracing and multiple importance sampling; and neural network techniques for efficient sampling and denoising. Further discusses recent advances in 3D

modeling and reconstruction, such as neural network-based 3D reconstruction; inverse rendering using neural radiance fields and differentiable rendering; and generative modeling for images, videos, and 3D data.

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CMSC798

(Perm Req)

Master's Non-Thesis Research

[Syllabus Repository \(0\)](#)



Credits: 1 - 3

~~Grad Meth: Reg~~

Contact department for information to register for this course.

CMSC799

(Perm Req)

Master's Thesis Research

[Syllabus Repository \(0\)](#)



Credits: 1 - 6

~~Grad Meth: S-F~~

Contact department for information to register for this course.

CMSC801

Department Internal Research Seminar

[Syllabus Repository \(0\)](#)





Credits: 1

~~Grad Meth: S-F~~

Credit only granted for: CMSC798E or CMSC801.

Formerly: CMSC798E.

Research overviews from faculty to help introduce departmental research to graduate students.

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CMSC818I

Advanced Topics in Computer Systems; Large Language Models, Security, and Privacy

[Syllabus Repository \(0\)](#)





Credits: 3

Grad Meth: Reg

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CMSC818J

Advanced Topics in Computer Systems; Domain Specific Architecture



[Syllabus Repository \(0\)](#)



Credits: 3

Grad Meth: Reg

Cross-listed with ENEE759c. Credit only granted for CMSC818J or ENEE759C.

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CMSC818T

Advanced Topics in Computer Systems; Applied Cryptographic Systems and Privacy Enhancing Technologies.

[Syllabus Repository \(0\)](#)



Credits: 3

Grad Meth: Reg

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CMSC818V

Advanced Topics in Computer Systems; Machine Learning for Physical Sensing and Perception

[Syllabus Repository \(0\)](#)



Credits: 3

Grad Meth: Reg

Prerequisites: Enrollment in a Master's or Doctoral program, or permission of the instructor.

Description: This course delves into advanced machine learning techniques for physical sensing and real-world perception. Topics include multimodal 3D volumetric rendering with physics-informed priors, ultra-low-power navigation with metamaterial sensing, urban localization via wireless signal patterns, sparse sensing for underwater imaging, and integrating spatial knowledge into language models for perception-aware AI.

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CMSC828J

Advanced Topics in Information Processing; Common-sense Reasoning and Natural Language Understanding

[Syllabus Repository \(1\)](#)

Credits: 3

Grad Meth: Reg

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CMSC828V

Advanced Topics in Information Processing; Numerical Methods for Data Science and Machine Learning

[Syllabus Repository \(0\)](#)

Credits: 1 - 3

Grad Meth: Reg, Aud., S-F

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CMSC838B

Advanced Topics in Programming Languages; Differentiable Programming

[Syllabus Repository \(0\)](#)

Credits: 3

Grad Meth: Reg

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CMSC838L

Advanced Topics in Programming Languages; Programming Languages and Computer Architecture

[Syllabus Repository \(0\)](#)

Credits: 3

Grad Meth: Reg

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CMSC839A

Advanced Topics in Human-Computer Interaction; Embodied Media Design



[Syllabus Repository \(0\)](#)



Credits: 3

~~Grad Meth: Reg~~

Explores the potential of human augmentation technologies, such as wearable computing, haptics, virtual reality, and more, to enhance human physical, perceptual, and cognitive capabilities. To achieve this, students will read relevant literature from the fields of Psychology, Cognitive Science, and Human-Computer Interaction. Additionally, students will create low-fidelity paper mockups and a prototype based on digital/analog circuit design, mechanical design, and a programming environment.

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CMSC839C

Advanced Topics in Human-Computer Interaction; Governing Algorithms & Algorithmic Governance

[Syllabus Repository \(0\)](#)



Credits: 3

~~Grad Meth: Reg~~

Cross-listed with INST878D. Credit only granted for INST878D or CMSC839C.

This cross-cutting interdisciplinary course, taught jointly between the College of Information Studies and the Department of Computer Science, investigates the role that algorithms and automated decision-making systems play in markets, societies, and policymaking. The course connects policy and computational conceptualizations of transparency, security, fairness, privacy, manipulation, and accountability through a series of casestudies and burning debates. Students will collaborate cross-disciplinary and be encouraged to work through difficult trade-offs to reach consensus. By discussing recent applications of algorithms for social and consumer sorting, and the moderation and generation of content, students will engage with the pressing challenges and opportunities in the governance of and by algorithms.

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CMSC839E

Advanced Topics in Human-Computer Interaction; Uncertainty Communication for Decision-Making

[Syllabus Repository \(1\)](#)



Credits: 3

~~Grad Meth: Reg~~

Human-Computer Interaction (HCI) research topics focusing on model uncertainty and decision-making. We will cover a range of models, from linear regression to probabilistic forecasts and AI foundation models, and explore how to help human users understand manage uncertainty in these computational models. Core topics include statistical communication, explainability, decision-making, uncertainty visualization, and LLM/LMM uncertainty. The course format includes a combination of readings, presentations, discussions, and lectures.

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CMSC848B

Selected Topics in Information Processing; Computational Imaging

[Syllabus Repository_\(0\)](#)



Credits: 3

~~Grad Meth:~~ Reg

Restriction: Must be in the Computer Science or Electrical and Computer Engineering Master's or Doctoral programs, or permission of instructor.

Cross-listed with ENEE739Z. Credit only granted for CMSC848B or ENEE739Z.

Introduces various computational imaging systems and the algorithms that underlie their operation. Particular emphasis will be placed on recently developed learning based reconstruction algorithms. This is a mixed lecture/seminar course.

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CMSC848I

Selected Topics in Information Processing; AI Agents and Sequential Decision Making

[Syllabus Repository_\(0\)](#)



Credits: 3

~~Grad Meth:~~ Reg

AI-based agents need to operate in complex environments to make sequences of decisions to achieve some known goal. Many learning frameworks for sequential decision making exist, including reinforcement learning, imitation learning, learning from instructions, and others. In this course we will cover the foundations of all these methods, building up to modern AI-based agents that are enabled by large foundation models such as large language models and large vision/language models.

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CMSC848K

Selected Topics in Information Processing; Multimodal Foundation Models

[Syllabus Repository_\(0\)](#)



Credits: 3

~~Grad Meth:~~ Reg

Discusses recent foundation models proposed in the literature, with a focus on vision-language models. Topics include large language models, vision-language models, and vision-audio models.

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CMSC848P

Selected Topics in Information Processing; Theory of Robust Machine Learning

[Syllabus Repository \(0\)](#)



Credits: 3

Grad Meth: Reg

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CMSC858J

Advanced Topics in Theory of Computing

[Syllabus Repository \(0\)](#)



Credits: 3

Grad Meth: Reg

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CMSC858U

Advanced Topics in Theory of Computing

[Syllabus Repository \(0\)](#)



Credits: 3

Grad Meth: Reg

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CMSC898

Pre-Candidacy Research

[Syllabus Repository \(0\)](#)



Credits: 1 - 8

Grad Meth: Reg

Contact department for information to register for this course.

CMSC899



(Perm Req)

Doctoral Dissertation Research

[Syllabus Repository \(0\)](#)



Credits: 6

Grad Meth: S-F

Contact department for information to register for this course.

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