College of Science
Bachelor of Science in Computational Modeling and Data Analytics
Major in Computational Modeling and Data Analytics (CMDA)

For students entering under UG catalog 2023–2024

CORE REQUIREMENTS (18 credits)
Complete all following courses in CMDA and Mathematics.
*Courses marked with * will be used for computing the "in major" GPA.*

CMDA 3605 *	Mathematical Modeling: Methods and Tools *(Pre: (CS 1114 or CS 1064 or MATH 3054), (MATH 2114 or MATH 2114H or MATH 2405H), (MATH 2204 or MATH 2204H or MATH 2406H or CMDA 2006), (MATH 2214 or MATH 2214H or MATH 2406H or CMDA 2006))*	(3)( )
CMDA 3606 *	Mathematical Modeling: Methods and Tools *(Pre: CMDA 3605)*	(3)( )
CMDA/CS 3634 *	Computer Science Foundations for Computational Modeling & Data Analytics *(Pre: CS 2114)*	(3)( )
CMDA/CS/STAT 3654 *	Introductory Data Analytics & Visualization *(Pre: (CS 1114 or CS 1044 or CS 1054 or CS 1064), (MATH 2224 or MATH 2224H or MATH 2204 or MATH 2204H or MATH 2406H or CMDA 2005), (STAT 3006 or STAT 4105 or STAT 4705 or STAT 4714 or CMDA 2006))*	(3)( )
CMDA/CS/STAT 4654 *	Intermediate Data Analytics and Machine Learning *(Pre: (STAT 3654 or CS 3654 or CMDA 3654), (STAT 3104 or STAT 4106 or STAT 4706 or CMDA 2006))*	(3)( )
MATH 2114 *	Introduction to Linear Algebra *(Pre: MATH 1225 or MATH 1226)*	(3)( )

MAJOR REQUIREMENTS (24 credits)
Complete all following courses in CMDA, Computer Science, and Mathematics.
*Courses marked with * will be used for computing the "in major" GPA.*
 # Any approved First Year Experience (FYE) Course at Virginia Tech will satisfy this requirement.
† MATH 2204, MATH 2214*, STAT 3005*, STAT 3006* & STAT 3104* substitute for CMDA 2005 & CMDA 2006.*
‡ CS 1114 will substitute for CS 1064 and CS 2064.*

CMDA 1634 *#	Discovering Computational Modeling and Data Analytics	(3)( )
CMDA 2005 *†	Integrated Quantitative Sciences *(Pre: MATH 1226, Co: MATH 2114)*	(6)( )
CMDA 2006 *†	Integrated Quantitative Sciences *(Pre: CMDA 2005, (MATH 2114 or MATH 2114H))*	(6)( )
CS 1064 *‡	Introduction to Programming in Python	(3)( )
CS 2064 *‡	Intermediate Programming in Python *(Pre: CS 1064)*	(3)( )
CS 2114 *	Software Design and Data Structures *(Pre: CS 1114 or CS 2064)*	(3)( )

RESTRICTED ELECTIVES (12 credits)
Complete four courses from the list below (continued on the next page).
These courses, all marked with *, will also be used for computing the "in major" GPA.

CMDA/ECON 4314 *	Big Data Economics *(Pre: ECON 3254 or ECON 4304 or CMDA 3654 or STAT 3006)*	(3)( )
CMDA 4604 *	Intermediate Topics in Mathematical Modeling *(Pre: CMDA 3606)*	(3)( )
CMDA 4634 *	Scalable Computing for Computational Modeling and Data Analytics *(Pre: (CMDA 3634 or CS 3634 or CS 4234), (CMDA 3654 or CS 3654 or STAT 3654), (CMDA 3605 or CS 3414 or MATH 3414 or MATH 4445)*	(3)( )
CMDA/STAT 4664 *	Computational Intensive Stochastic Modeling *(Pre: (STAT 4106 or CMDA 3605), (CS 1114 or CS 1064 or STAT 2005))*	(3)( )
CS 3114 *	Data Structures and Algorithms *(Pre: CS 2114, CS 2505, (MATH 2534 or MATH 3034))*	(3)( )
CS 4104 *	Data and Algorithm Analysis *(Pre: CS 3114, (MATH 3034 or MATH 3134))*	(3)( )
CS 4824 */ECE 4424 *	Machine Learning *(Pre: (ECE 2574 or CS 2114), (STAT 4604 or STAT 4705 or STAT 4714))*	(3)( )
CS 4604 *	Introduction to Data Base Management Systems *(Pre: CS 3114)*	(3)( )
MATH 3134 *	Applied Combinatorics *(Pre: MATH 1226, (MATH 2534 or MATH 3034))*	(3)( )
MATH 4144 *	Linear Algebra II *(Pre: MATH 3144)*	(3)( )
MATH 4175 *	Cryptography *(Pre: (MATH 3034 or MATH 3124 or MATH 3134 or MATH 3144 or MATH 3224 or MATH 4134 or CMDA 3605))*	(3)( )
MATH 4176 *	Cryptography *(Pre: MATH 4175 or CMDA 3606 or (MATH 3034, MATH 3124) or (MATH 3034, MATH 3134) or (MATH 3034, MATH 3144) or (MATH 3034, MATH 3224) or (MATH 3034, MATH 4134) or (MATH 3124, MATH 3134) or (MATH 3124, MATH 3144) or (MATH 3124, MATH 3224) or (MATH 3124, MATH 4134) or (MATH 3134, MATH 3144) or (MATH 3134, MATH 3224) or (MATH 3134, MATH 4134) or (MATH 3144, MATH 3224) or (MATH 3144, MATH 4134) or (MATH 3224, MATH 4134))*	(3)( )
MATH 4425 *	Fourier Series and Partial Differential Equations *(Pre: (MATH 2406H or CMDA 2006 or MATH 2214 or MATH 2214H), MATH 3224)*	(3)( )
MATH 4426 *	Fourier Series and Partial Differential Equations *(Pre: MATH 4425)*	(3)( )
MATH 4445 *	Introduction to Numerical Analysis *(Pre: MATH 2406H or (CMDA 2005, CMDA 2006) or (MATH 2214 or MATH 2214H) or (MATH 2224 or MATH 2224H) or (MATH 2204 or MATH 2204H))*	(3)( )
MATH 4446 *	Introduction to Numerical Analysis *(Pre: MATH 2406H or (CMDA 2005, CMDA 2006) or (MATH 2214 or MATH 2214H) or (MATH 2224 or MATH 2224H) or (MATH 2204 or MATH 2204H))*	(3)( )
STAT 4004 *	Methods of Statistical Computing *(Pre: STAT 4105, STAT 4214)*	(3)( )

STAT 4204 *	Experimental Designs *(Pre: STAT 3006 or STAT 3616 or STAT 4106 or STAT 4706 or STAT 5605 or STAT 5615 or CMDA 2006)*	(3)( )
STAT 4214 *	Methods of Regression Analysis *(Pre: STAT 3006 or STAT 3616 or STAT 4106 or STAT 4706 or STAT 5606 or STAT 5616 or CMDA 2006)*	(3)( )
STAT 4364 *	Introduction to Statistical Genomics *(Pre: (MATH 2224 or MATH 2224H or MATH 2204 or MATH 2204H or MATH 2406H or CMDA 2005), (STAT 3104 or STAT 4105 or CMDA 2006), (STAT 3006 or STAT 3616 or STAT 4706 or CMDA 2006))*	(3)( )
STAT 4444 *	Applied Bayesian Statistics *(Pre: (MATH 2224 or MATH 2224H or MATH 2204 or MATH 2204H or MATH 2406H or CMDA 2005), (STAT 3104 or STAT 4105 or STAT 4705 or CMDA 2006), (STAT 3006 or STAT 3616 or STAT 4706 or CMDA 2006))*	(3)( )
STAT 4504 *	Applied Multivariate Analysis *(Pre: STAT 3006 or STAT 4706 or CMDA 2006 or STAT 3616)*	(3)( )
STAT 4514 *	Introduction to Categorical Data Analysis *(Pre: STAT 3006 or STAT 3616 or STAT 4106 or STAT 4706)*	(3)( )
STAT 4534 *	Applied Statistical Time Series Analysis *(Pre: STAT 3006 or STAT 4104 or STAT 4706 or STAT 4714 or STAT 3616 or BIT 2406 or CMDA 2006)*	(3)( )
PHYS 4755*	Introduction to Computational Physics *(Pre: PHYS 2306, (CS 1044 or CS 1054 or CS 1064 or CS 1114 or ECE 1574 or AOE 2074 or ESM 2074))*	(3)( )
PHYS 4756*	Introduction to Computational Physics *(Pre: PHYS 4455 and PHYS 4755)*	(3)( )

REQUIREMENTS FOR THE COLLEGE AND UNIVERSITY
PATHWAYS GENERAL EDUCATION (47 credits)

Concept 1f: Foundational Discourse

_____ (3) ( )   _____ (3) ( )

Concept 1a: Advanced/Applied Discourse

_____ (3) ( )

Concept 2: Critical Thinking in the Humanities

_____ (3) ( )   _____ (3) ( )

Concept 3: Reasoning in the Social Sciences

_____ (3) ( )   _____ (3) ( )

**REQUIREMENTS FOR THE COLLEGE AND UNIVERSITY
PATHWAYS GENERAL EDUCATION**, *continued*

Concept 4: Reasoning in the Natural Sciences

_____ (3) ( )   _____ (3) ( )

Concept 5f: Foundational Quantitative and Computational Thinking

MATH 1225 Calculus of a Single   (4) ( )
MATH 1226 Calculus of a Single Variable *(Pre: MATH 1225)*   (4) ( )

Concept 5a: Advanced/Applied Quantitative and Computational Thinking

CMDA 4864* CMDA Capstone   (3) ( )
(Pre: CMDA 3605, (CMDA 3634 or CS 3634), (CMDA 3654 or CS 3654 or STAT 3654))

Concept 6a: Critique and Practice in the Arts

_____ (3) ( )

Concept 6d: Critique and Practice in Design

_____ (3) ( )

Concept 7: Critical Analysis and Equity and Identity in the United States

_____ (3) ( )

FREE ELECTIVES (19 credits)

_____ (3) ( )   _____ (3) ( )

_____ (3) ( )   _____ (3) ( )

_____ (3) ( )   _____ (4) ( )

Prerequisites

Some courses in the major requirements and electives above have prerequisites. Students are required to double check course prerequisites and equivalents. Please see your advisor or consult the Undergraduate Course Catalog for more information.

Progress Toward Degree

Three conditions are required for continuation in the major:

(1) Upon having attempted 72 total credit hours (including transfer, AP, advanced standing, credit by examination, course withdrawal) majors must have completed the following courses with grades of **C−** or better in a maximum of two attempts (including attempts that

were withdrawn): MATH 1225; MATH 1226; MATH 2114; (CMDA 2005 and CMDA 2006) or (STAT 3005, 3006, 3104; MATH 2204, 2214).

(2) Upon having attempted 72 total credit hours (including transfer, AP, advanced standing, credit by examination, course withdrawal) majors must have completed the following courses with grades of **C** or better in a maximum of two attempts (including attempts that were withdrawn): (CS 1064 and CS 2064) or CS 1114; CS 2114.

(3) Upon having attempted 12 credits of courses designated as counting for the in-major GPA (not including credits from withdrawn courses), students must maintain an in-major GPA of 2.0 or better.

Foreign Language Requirement

Students who did not successfully complete at least two years of a single foreign, classical, or sign language during high school must successfully complete six credit hours of a single foreign, classical, or sign language at the college level. Courses taken to meet this requirement do not count toward the hours required for graduation. Please consult the Undergraduate Catalog for details.

Graduation Requirements

120 credit hours are required for graduation. These credits must include the courses required for the major (see above sections). To graduate, a student must have at least a 2.0 in-major GPA and overall GPA. If 120 credit hours are reached and a student does not meet the GPA requirement, the student must take additional in-major courses to raise the in-major GPA to a 2.0.