College of Science
Bachelor of Science in Computational Modeling and Data Analytics
Major in Computational Modeling and Data Analytics (CMDA)
Option: Biological Sciences

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.*

Course	Title	Credits
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.

Course	Title	Credits
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)( )

BIOLOCIAL SCIENCES COURSES FOR THE BIOLOGICAL SCIENCES OPTION (8 credits)		
Complete the following courses.		
BIOL 1105	Principles of Biology	(3)( )
BIOL 1115	Principles of Biology Lab *(Co: BIOL 1105)*	(1)( )
BIOL 1106	Principles of Biology	(3)( )
BIOL 1116	Principles of Biology Lab *(Co: BIOL 1106)*	(1)( )

BIOLOGICAL SCIENCES COURSES FOR THE BIOLOGICAL SCIENCES OPTION (6 credits)		
Complete two of the five following courses.		
These courses, marked with *, will be used for computing the "in major" GPA.		
BIOL 2004 *	Genetics *(Pre: (BIOL 1005 or BIOL 1105 or BIOL 1205H or ISC 2105), (BIOL 1006 or BIOL 1106 or BIOL 1206H), (CHEM 1036 or CHEM 1056 or CHEM 1036H or CHEM 1056H or CHEM 1016 or ISC 2105))*	(3)( )
BIOL 2134 *	Cell Function & Differentiation *(Pre: BIOL 2004)*	(3)( )
BIOL 2604 *	General Microbiology *(Pre: (BIOL 1005 or BIOL 1105 or BIOL 1205H or ISC 2105), (BIOL 1006 or BIOL 1106 or BIOL 1206H), CHEM 1036 or CHEM 1056 or CHEM 1036H or CHEM 1056H or ISC 2105))*	(3)( )
BIOL 2704 *	Evolutionary Biology *(Pre: (BIOL 1005 or BIOL 1105 or BIOL 1205H or ISC 2105), (BIOL 1006 or BIOL 1106 or BIOL 1206H))*	(3)( )
BIOL 2804 *	Ecology *(Pre: (BIOL 1005 or BIOL 1105 or BIOL 1205H or ISC 2105), (BIOL 1006 or BIOL 1106 or BIOL 1206H))*	(3)( )

BIOL/SYSB ELECTIVES FOR THE BIOLOGICAL SCIENCES OPTION (6–8 credits)		
Complete two courses from the list below.		
These courses, marked with *, will be used for computing the "in major" GPA.		
BIOL 4004 *	Freshwater Ecology *(Pre: BIOL 2804 or BIOL 2804H)*	(4)( )
BIOL 4114 *	Global Change Ecology *(Pre: (BIOL 2704 or BIOL 2704H), BIOL 2804)*	(3)( )
BIOL 4134 *	Evolutionary Genetics *(Pre: BIOL 2004, (BIOL 2704 or BIOL 2704H))*	(3)( )
BIOL 4564 *	Infectious Disease Ecology *(Pre: (BIOL 2704 or BIOL 2704H), (BIOL 2804 or BIOL 2804H))*	(3)( )
BIOL 4624 *	Microbial Genetics *(Pre: BIOL 2004, (BIOL 2604 or BIOL 2604H))*	(3)( )
BIOL 4664 *	Virology *(Pre: (BIOL 2104 or BIOL 2134), (BIOL 2604 or BIOL 2604H), BIOL 2614)*	(3)( )
BIOL 4874 *	Cancer Biology *(Pre: BIOL 2134)*	(3)( )
SYSB 3035 *	Systems Biology of Genes and Proteins *(Pre: BIOL 2004)*	(4)( )
SYSB 3036 *	Systems Biology of Genes and Proteins *(Pre: SYSB 3035)*	(4)( )
SYSB 3115 *	Network Dynamics and Cell Physiology *(Pre: SYSB 2034)*	(4)( )
SYSB 3116 *	Network Dynamics and Cell Physiology *(Pre: SYSB 3115)*	(4)( )

CMDA ELECTIVES FOR BIOLOGICAL SCIENCES OPTION (3 credits)
*Complete one course from the list below. This course, marked with *, will be used for computing the "in major" GPA.*

CMDA/STAT 4664 *	Computational Intensive Stochastic Modeling *(Pre: (STAT 4106 or CMDA 3605), (CS 1114 or CS 1064 or STAT 2005))*	(3)( )
CS 3824 *	Introduction to Computational Biology and Bioinformatics *(Pre: CS 3114)*	(3)( )
MATH 4454 *	Applied Mathematical Modeling *(Pre: MATH 3214)*	(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 STAT 4705 or CMDA 2006), (STAT 3006 or STAT 3616 or STAT 4706 or CMDA 2006))*	(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) ( )

Concept 4: Reasoning in the Natural Sciences

CHEM 1035 General Chemistry (3) ( )
CHEM 1036 General Chemistry *(Pre: CHEM 1035 or CHEM 1055 or CHEM 1055H)* (3) ( )

Concept 5f: Foundational Quantitative and Computational Thinking

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

Concept 5a: Advanced/Applied Quantitative and Computational Thinking

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

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

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 (6–8 credits)

_____ (3) ( )   _____(3–4) ( )

_____(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.