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

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)( )

PHYSICS OPTION REQUIREMENTS (10 credits)
Complete all following courses in Physics and CMDA.
*These courses, all marked with *, will be used for computing the "in major" GPA.*

PHYS 3324 *	Modern Physics *(Pre: PHYS 2306, Co: PHYS 2504 and (MATH 2214 or MATH 2214H))*	(4)( )
PHYS 4755 *	Intro 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)( )
CMDA 4604 *	Intermediate Topics in Mathematical Modeling *(Pre: CMDA 3606)*	(3)( )

PHYSICS ELECTIVES FOR THE PHYSICS OPTION (15 credits)
Complete five courses from the list below.
*These courses, all marked with *, will be used for computing the "in major" GPA.*

PHYS 3355 *	Intermediate Mechanics *(Pre: PHYS 2305, PHYS 2306, PHYS 2504, (MATH 2214 or MATH 2214H), (MATH 1224 or MATH 2204 or MATH 2204H))*	(3)( )
PHYS 3356 *	Intermediate Mechanics *(Pre: PHYS 3355)*	(3)( )
PHYS 3405 *	Intermediate Electricity & Magnetism *(Pre: PHYS 2305, PHYS 2306, PHYS 2504, (MATH 2214 or MATH 2214H))*	(3)( )
PHYS 3406 *	Intermediate Electricity & Magnetism *(Pre: PHYS 3405*	(3)( )
PHYS 3704 *	Thermal Physics *(Pre: PHYS 2306, PHYS 3324; Co: PHYS 2504, (MATH 2214 or MATH 2214H))*	(3)( )
PHYS 4455 *	Introduction to Quantum Mechanics *(Pre: Phys: 3356, Co: PHYS 3406)*	(3)( )
PHYS 4456 *	Introduction to Quantum Mechanics *(Pre: PHYS 4455)*	(3)( )
PHYS 4554 *	Introduction to Solid State Physics *(Pre: PHYS 4456)*	(3)( )
PHYS 4574 *	Nanotechnology *(Pre: (PHYS 2205, PHYS 2206) or (PHYS 2305, PHYS 2306))*	(3)( )
PHYS 4614 *	Optics *(Pre: PHYS 2306, MATH 2214, (MATH 2224 or MATH 2204 or MATH 2204H))*	(3)( )
PHYS 4664 *	Astroparticle Physics *(Pre: PHYS 3655 or 3656))*	(3)( )
PHYS 4674 *	Introduction to General Relativity *(Pre: PHYS 3355, (MATH 2214 or MATH 2214H or MATH 2514); Co: PHYS 3406)*	(3)( )
PHYS 4714 *	Introduction to Biophysics *(Pre: PHYS 2206 or PHYS 2306 or ISC 2106H)*	(3)( )

REQUIREMENTS FOR THE COLLEGE AND UNIVERSITY PATHWAYS GENERAL EDUCATION (49 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

PHYS 2305 Foundations of Physics (4) ( )
(Pre: (MATH 1205 or MATH 1205H or MATH 1225) or (MATH 1206 or MATH 1206H or MATH 1226))

PHYS 2306 Foundations of Physics (4) ( )
(Pre: PHYS 2306, (MATH 1206 or MATH 1206H or MATH 1226))

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 (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 (4 credits)

_____ (3) ( ) _____ (1) ( )

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.