

# COMPUTATIONAL MODELING AND DATA ANALYTICS MAJOR WITH CRYPTOGRAPHY AND CYBERSECURITY OPTION

## Program Curriculum

Code	Title	Credits
<b>Degree Core Requirements</b>		
CMDA 3605	Mathematical Modeling: Methods and Tools <sup>1</sup>	3
CMDA 3606	Mathematical Modeling: Methods and Tools <sup>1</sup>	3
CMDA 3634	Computer Science Foundations for Computational Modeling and Data Analytics <sup>1</sup>	3
CMDA 3654	Introductory Data Analytics and Visualization <sup>1</sup>	3
CMDA 4654	Intermediate Data Analytics and Machine Learning <sup>1</sup>	3
MATH 2114	Introduction to Linear Algebra	3
Subtotal		18
<b>Major Requirements</b>		
CMDA 1634	Discovering Computational Modeling and Data Analytics <sup>1</sup>	3
CMDA 2005	Integrated Quantitative Sciences <sup>1,2</sup>	6
CMDA 2006	Integrated Quantitative Sciences <sup>1,2</sup>	6
CS 1064	Introduction to Programming in Python <sup>1,3</sup>	3
CS 2064	Intermediate Programming in Python <sup>1,3</sup>	3
CS 2114	Software Design and Data Structures <sup>1</sup>	3
Subtotal		24
<b>Option Required Courses</b>		
BIT 2164	Foundations of Contemporary Security Environments <sup>1</sup>	3
BIT 4164	Future of Security: Integrative Solutions for Complex Security Systems <sup>1</sup>	3
CS 2505	Introduction to Computer Organization <sup>1</sup>	3
MATH 2534	Introduction to Discrete Mathematics <sup>1</sup>	3
MATH 4175	Cryptography <sup>1</sup>	3
MATH 4176	Cryptography <sup>1</sup>	3
Subtotal		18
<b>Additional Course Requirements</b>		
Select one of the following:		3
CS 3714	Mobile Software Development <sup>1</sup>	
CS 3754	Cloud Software Development <sup>1</sup>	
Subtotal		3
<b>Restricted Electives</b>		
Select two of the following:		6
BIT 4624	Cybersecurity Analytics for Business <sup>1</sup>	
CMDA 4634	Scalable Computing for Computational Modeling and Data Analytics <sup>1</sup>	
CS 4264	Principles of Computer Security <sup>1</sup>	
FIN 4014	Cyberlaw and Policy <sup>1</sup>	
MATH 3124	Modern Algebra <sup>1</sup>	
MATH 3134	Applied Combinatorics and Graph Theory <sup>1</sup>	

PHYS 4254	Quantum Information Technologies <sup>1</sup>	
Subtotal		6
<b>Free Electives</b>		
Select remaining credits of free electives		4
Subtotal		4
<b>Pathways to General Education</b>		
<i>Pathways Concept 1 - Discourse</i>		
Select six credits in Pathway 1f ( <a href="https://catalog.vt.edu/course-search/?attrs_pathways=attrs_pathways_G01F">https://catalog.vt.edu/course-search/?attrs_pathways=attrs_pathways_G01F</a> )		6
Select three credits in Pathway 1a ( <a href="https://catalog.vt.edu/course-search/?attrs_pathways=attrs_pathways_G01A">https://catalog.vt.edu/course-search/?attrs_pathways=attrs_pathways_G01A</a> )		3
<i>Pathways Concept 2 - Critical Thinking in the Humanities</i>		
Select six credits in Pathway 2 ( <a href="https://catalog.vt.edu/course-search/?attrs_pathways=attrs_pathways_G02">https://catalog.vt.edu/course-search/?attrs_pathways=attrs_pathways_G02</a> )		6
<i>Pathways Concept 3 - Reasoning in the Social Sciences</i>		
Select six credits in Pathway 3 ( <a href="https://catalog.vt.edu/course-search/?attrs_pathways=attrs_pathways_G03">https://catalog.vt.edu/course-search/?attrs_pathways=attrs_pathways_G03</a> )		6
<i>Pathways Concept 4 - Reasoning in the Natural Sciences</i>		
Select six credits in Pathway 4 ( <a href="https://catalog.vt.edu/course-search/?attrs_pathways=attrs_pathways_G04">https://catalog.vt.edu/course-search/?attrs_pathways=attrs_pathways_G04</a> )		6
<i>Pathways Concept 5 - Quantitative and Computational Thinking</i>		
MATH 1225	Calculus of a Single Variable (5F)	4
MATH 1226	Calculus of a Single Variable (5F)	4
CMDA 4864	Computational Modeling and Data Analytics Capstone Project (5A) <sup>1</sup>	3
<i>Pathways Concept 6 - Critique and Practice in Design and the Arts</i>		
Select three credits in Pathway 6a ( <a href="https://catalog.vt.edu/course-search/?attrs_pathways=attrs_pathways_G06A">https://catalog.vt.edu/course-search/?attrs_pathways=attrs_pathways_G06A</a> )		3
Select three credits in Pathway 6d ( <a href="https://catalog.vt.edu/course-search/?attrs_pathways=attrs_pathways_G06D">https://catalog.vt.edu/course-search/?attrs_pathways=attrs_pathways_G06D</a> )		3
<i>Pathways Concept 7 - Critical Analysis of Identity and Equity in the United States</i>		
Select three credits in Pathway 7 ( <a href="https://catalog.vt.edu/course-search/?attrs_pathways=attrs_pathways_G07">https://catalog.vt.edu/course-search/?attrs_pathways=attrs_pathways_G07</a> )		3
Subtotal		47
<b>Total Credits</b>		<b>120</b>

<sup>1</sup> Course will be used for computing the "in major" GPA.  
<sup>2</sup> MATH 2204 Introduction to Multivariable Calculus, MATH 2214 Introduction to Differential Equations, STAT 3005 Statistical Methods, STAT 3006 Statistical Methods, & STAT 3104 Probability and Distributions will substitute for CMDA 2005 Integrated Quantitative Sciences and CMDA 2006 Integrated Quantitative Sciences.  
<sup>3</sup> CS 1114 Introduction to Software Design will substitute for CS 1064 Introduction to Programming in Python and CS 2064 Intermediate Programming in Python.

## 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.

## 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): 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 Calculus of a Single Variable; MATH 1226 Calculus of a Single Variable; MATH 2114 Introduction to Linear Algebra; (CMDA 2005 Integrated Quantitative Sciences and CMDA 2006 Integrated Quantitative Sciences) or (STAT 3005 Statistical Methods, STAT 3006 Statistical Methods, STAT 3104 Probability and Distributions; MATH 2204 Introduction to Multivariable Calculus, MATH 2214 Introduction to Differential Equations).
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 Introduction to Programming in Python and CS 2064 Intermediate Programming in Python) or CS 1114 Introduction to Software Design; CS 2114 Software Design and Data Structures.
3. Upon having attempted 12 credit hours of courses designated as counting for the in-major GPA, 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.

## Prerequisites

Some courses may 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.

## Acceptable Substitution

MATH 2534 Introduction to Discrete Mathematics: MATH 3034 Introduction to Proofs