Bioinformatics, MS (Online)

The Master of Science in Bioinformatics seeks to provide students with core knowledge in bioinformatics programming, integrating knowledge from the biological, computational, and mathematical disciplines. Upon completion, students are equipped to apply bioinformatics and computational methods to biological problems. Students in the MS program have the opportunity to gain professional work experience via co-op.

The program consists of core coursework in computational methods, programming, and statistics, enhanced by electives in molecular biology, biochemistry, molecular modeling, web development, database design and management, data mining, and other related topics.

Program Requirements

Complete all courses and requirements listed below unless otherwise indicated.

Core Requirements

Code	Title	Hours
Programming		
BINF 6200	Bioinformatics Programming	4
Computational Methods		
BINF 6310	Introduction to Bioinformatics	4
Statistics		
MATH 7340	Statistics for Bioinformatics	4
Research and Seminar		
Complete one of the following:		1-2
BIOL 6381	Ethics in Biological Research	
NNMD 5310	Bioethics in the Age of Artificial Intelligence	
Professional Development		
EESC 6500	Pathways to Professional Success	1

Coursework Pathway

Code	Title	Hours
Complete 4 semester hours from the restricted electives or additional electives lists.		4

Concentration or Electives Option

A concentration is not required. Students who choose not to declare a concentration will complete the electives option.

- Bioinformatics Enterprise (p. 1)
- Biotechnology (p. 2)
- Data Analytics (p. 2)
- Health Informatics (p. 2)
- Omics (p. 2)
- Electives Option (p. 2)

Optional Co-op Experience

Code	Title	Hours
BINF 6964	Co-op Work Experience	0
or BINF 6965	Co-op Work Experience Abroad	

Program Credit/GPA Requirements

32 total semester hours required
Minimum 3.000 GPA required

BIOINFORMATICS ENTERPRISE CONCENTRATION

Code	Title	Hours
BIOT 5219	The Biotechnology Enterprise	2
BIOT 5225	Managing and Leading a Biotechnology Company	3

BIOT 5228	Planning and Executing Biotechnology Projects	3
Complete 6 semester hours of coursework from the restricted electives list below. (p. 2)		6

BIOTECHNOLOGY CONCENTRATION

Code	Title	Hours
BIOT 5120	Foundations in Biotechnology	3
BIOT 5621	Protein Principles in Biotechnology	3
BIOT 5750	Molecular Approaches in Biotechnology	3
Complete 5 semester hours of coursework from the restricted electives list below. (p. 2)		5

DATA ANALYTICS CONCENTRATION

Code	Title	Hours
DA 5020	Collecting, Storing, and Retrieving Data	4
DA 5030	Introduction to Data Mining/Machine Learning (or Elective)	4
Complete one of the following:		4
INSH 5301	Introduction to Computational Statistics	
INSH 5302	Information Design and Visual Analytics	
Complete 3 semester hours from the restricted electives list below. (p. 2)		3

HEALTH INFORMATICS CONCENTRATION

Code	Title	Hours
Complete at least 9 semester hours from the following:		9
HINF 5101	Introduction to Health Informatics and Health Information Systems	
HINF 5102	Data Management in Healthcare	
HINF 5105	The American Healthcare System	
HINF 5110	Global Health Information Management	
HINF 5200	Theoretical Foundations in Personal Health Informatics	
HINF 6220	Database Design, Access, Modeling, and Security	
Complete 5 semester hours of coursework from the restricted electives list below. (p. 2)		5

OMICS CONCENTRATION

Code	Title	Hours
BINF 6400	Genomics in Bioinformatics	4
BINF 6420	Omics in Bioinformatics	4
BINF 6430	Transcriptomics in Bioinformatics	4
Complete 2 semester hours of coursework from the restricted electives or additional electives lists below.		2

ELECTIVES OPTION

Code	Title	Hours
Complete 10 hours from the restricted electives list below. (p. 2)		10
Complete 4 semester hours of coursework from the restricted electives or additional electives lists below.		4

RESTRICTED ELECTIVES

Code	Title	Hours
BINF 6250	Algorithmic Foundations in Bioinformatics	
BINF 6400	Genomics in Bioinformatics	
BINF 6420	Omics in Bioinformatics	
BINF 6430	Transcriptomics in Bioinformatics	
BIOL 5100	Biology Colloquium	
BIOL 5543	Stem Cells and Regeneration	
BIOL 5585	Evolution	
BIOL 5593	Cell and Molecular Biology of Aging	
BIOL 6301	Molecular Cell Biology	
BIOL 6405	Prokaryotic Cell and Molecular Biology	
BIOL 6407	Biochemistry for Molecular Biologists	
BIOT 5120	Foundations in Biotechnology	

BIOT 5145	Biotechnology Lab Skills
BIOT 5219	The Biotechnology Enterprise
BIOT 5621	Protein Principles in Biotechnology
BIOT 5750	Molecular Approaches in Biotechnology
BIOT 5850	Higher-Order Structure Analytics
CHEM 5620	Protein Chemistry
CHEM 5638	Molecular Modeling
CS 5004	Object-Oriented Design
CS 5008	Data Structures, Algorithms, and Their Applications within Computer Systems
CS 5010	Programming Design Paradigm
CS 5100	Foundations of Artificial Intelligence
CS 5130	Applied Programming and Data Processing for AI
CS 5200	Database Management Systems
CS 5400	Principles of Programming Language
CS 5500	Foundations of Software Engineering
CS 5600	Computer Systems
CS 5800	Algorithms
CS 6120	Natural Language Processing
CS 6140	Machine Learning
CS 6200	Information Retrieval
CS 6220	Data Mining Techniques
DA 5020	Collecting, Storing, and Retrieving Data
DA 5030	Introduction to Data Mining/Machine Learning
DAMG 6105	Data Science Engineering with Python
DS 5010	Introduction to Programming for Data Science
DS 5020	Introduction to Linear Algebra and Probability for Data Science
DS 5220	Supervised Machine Learning and Learning Theory
DS 5230	Unsupervised Machine Learning and Data Mining
EEMB 5130	Population Dynamics
HINF 6220	Database Design, Access, Modeling, and Security
INFO 6105	Data Science Engineering Methods and Tools
INSH 5301	Introduction to Computational Statistics
INSH 5302	Information Design and Visual Analytics
MATH 5131	Introduction to Mathematical Methods and Modeling
MATH 7207	Algorithms for Optimization
MATH 7243	Machine Learning and Statistical Learning Theory 1
MATH 7339	Machine Learning and Statistical Learning Theory 2
MATH 7342	Mathematical Statistics
MATH 7344	Regression, ANOVA, and Design
NNMD 5310	Bioethics in the Age of Artificial Intelligence
PHSC 5905	Artificial Intelligence and Machine Learning in Drug Discovery: Concepts and Applications
PHSC 6214	Experimental Design and Biostatistics

ADDITIONAL ELECTIVES

Code	Title	Hours
Electives outside this list may be chosen in consultation with faculty advisor.		
BIOE 5235	Biomedical Imaging	
BIOE 5420	Cellular Engineering	
BIOE 6000	Principles of Bioengineering	
BIOE 6100	Medical Physiology	
BIOL 5549	Inventions in Microbial Biotechnology	
BIOL 5573	Medical Microbiology	
BIOL 5581	Biological Imaging	

BIOL 5583	Immunology
BIOL 5591	Advanced Genomics
BIOL 5821	Cell and Gene Therapies
BIOL 6300	Biochemistry
BIOL 6303	Neurobiology and Behavior
BIOT 5225	Managing and Leading a Biotechnology Company
BIOT 5228	Planning and Executing Biotechnology Projects
BIOT 5560	Bioprocess Fundamentals
BIOT 5635	Downstream Processes for Biopharmaceutical Production
BIOT 5640	Drug Product Processes for Biopharmaceuticals
BIOT 5700	Molecular Interactions of Proteins in Biopharmaceutical Formulations
BIOT 5810	Cutting-Edge Applications in Molecular Biotechnology
BIOT 5830	Regulatory Landscape of Cell and Gene Therapies
BIOT 5840	Cell and Gene Therapy Lab
BIOT 7245	Biotechnology Applications Laboratory
BIOT 7983	Special Topics in Biotechnology
CHEM 5550	Introduction to Glycobiology and Glycoprotein Analysis
CHEM 5617	Protein Mass Spectrometry Laboratory
CS 5610	Web Development
CS 5700	Fundamentals of Computer Networking
CS 6620	Fundamentals of Cloud Computing
CS 7150	Deep Learning
HINF 5101	Introduction to Health Informatics and Health Information Systems
HINF 5102	Data Management in Healthcare
HINF 5105	The American Healthcare System
HINF 5110	Global Health Information Management
HINF 5200	Theoretical Foundations in Personal Health Informatics
MATH 7203	Numerical Analysis 1
MATH 7205	Numerical Analysis 2
MATH 7233	Graph Theory
MATH 7241	Probability 1
MATH 7341	Probability 2
NNMD 5272	Nanomedicine Seminar
NNMD 5370	Nanomedicine Research Techniques
PHSC 5500	Repurposing Drugs for Cancer Immunotherapies
PHYS 5116	Network Science 1
PHYS 7332	Network Science Data 2