



Course Outline

Course Name: ***BINF5007-Introduction to Python for Bioinformatics***

Academic Year: 2025-2026

Faculty: Andres Felipe Melani De La Hoz, MSc

Program Coordinator: Fathiya Mohamed, MBinf

Associate Dean: Erin Mandel-Shorser, PhD

Schedule Type: LEC

Land Acknowledgement

Humber College is located within the traditional and treaty lands of the Mississaugas of the Credit. Known as Adoobiigok [A-doe-bee-goke], the "Place of the Black Alders" in Michi Saagiig [Mi-Chee Saw-Geeg] language, the region is uniquely situated along Humber River Watershed, which historically provided an integral connection for Anishinaabe [Ah-nish-nah-bay], Haudenosaunee [Hoeden-no-shownee], and Wendat [Wine-Dot] peoples between the Ontario Lakeshore and the Lake Simcoe/Georgian Bay regions. Now home to people of numerous nations, Adoobiigok continues to provide a vital source of interconnection for all.

For more information, visit the Aboriginal Resource Centre (LRC2137) North Campus, (WEL301) Lakeshore Campus or www.humber.ca/aboriginal/

Faculty	Faculty of Health Sciences and Wellness
Program	Graduate Certificate in Clinical Bioinformatics, CB511
Course Name:	Introduction to Python for Bioinformatics
Pre-Requisite(s)	NA
Co-Requisite(s)	NA

Equates	None
Restrictions	This course is restricted to Clinical Bioinformatics Graduate Certificate Program
Credit Value	3
Total Course Hours	42

Developed by: Andres Felipe Melani De La Hoz, MSc

Approved by: Erin Mandel-Shorser, PhD

Course Description

This introduction to python for bioinformatics course supports learners in gaining the theoretical and practical skills to parse and manipulate biological data. Learners will write, test, and implement Python programs for use in bioinformatics analyses. This course also covers fundamental programming skills, including debugging, error handling, and optimizing code for efficiency.

Course Rationale

In this course learners gain the foundational python skills to retrieve biological data, and subsequently prepare it for analysis and visualization. Through hands-on exercises, learners build essential programming skills for the bioinformatics field.

Program Learning Outcomes Emphasized in this Course:

1. Employ programming language and scripting versatility to be able to automate processes at the application level.
2. Examine bioinformatics data to discover patterns, draw conclusions and generate predictions for subsequent experiments.
3. Comply with legal obligations, as well as with the professional and ethical standards that ensure privacy, security and confidentiality in the access, retention, storage and disposal of personal genetic data and related health information.
4. Complete complex genomic and proteomics applications using advanced principles of cell and molecular biology, pharmacology and toxicology, pathophysiology, endocrinology, and biochemistry.
5. Collaborate and communicate with members of the inter-professional health care team to optimize the health and well-being of individuals, based on their genetic profile.

Course Format(s)

LECTURE, ONLINE, TUTORIAL

Course Learning Outcomes

OQF Category	At the successful completion of the course, the student will have demonstrated an ability to:
Depth and Breadth of Knowledge	<ol style="list-style-type: none">1. Explain Python syntax, data types (Numbers, Booleans, Strings, Lists, Tuples, Dictionaries, Sets), type conversion, operators, and expressions.2. Recognize Python's capabilities: control statements, error handling, data visualization, file handling, reading/writing function, web services, and bioinformatics libraries for data manipulation, analysis, and visualization.
Knowledge of Methodologies	<ol style="list-style-type: none">3. Demonstrate an understanding of how regular expressions are used to improve the efficiency of data retrieval and processing in bioinformatics through pattern recognition.4. Describe how bioinformatics tools in python can be used to address biological questions and consider their limitations in application.
Application of Knowledge	

	<p>5. Utilize knowledge of python libraries and scripting techniques to ensure the chosen approach is appropriate for the data and optimized for performance in bioinformatics applications.</p> <p>6. Execute python scripts to process, analyze and manipulate biological sequence data contained within a variety of common bioinformatics file types.</p>
Communication Skills	<p>7. Articulate the rationale underlying the construction of python scripts, explaining the relevance of each component in processing the data to improve collective understanding within projects.</p> <p>8. Communicate results of bioinformatics analyses clearly through reporting and/or visualizations with python libraries to aid in interpretation of data.</p>
Professional Capacity/ Autonomy	<p>9. Integrate knowledge of biological context when developing python programs to ensure accurate decision making and high-quality results in bioinformatics analysis.</p> <p>10. Adhere to best practices in scripting including developing custom functions to enhance overall efficiency and user-friendliness of code.</p>

Assessment Weighting

Assessment		Weight (%)
In-class activities	Variables and data types	2.5
	Python data structures	2.5
	Python standard library and exceptions	2.5
	Algorithms with loops and conditional statements	2.5
	Creating functions and modules in Python	2.5
	Filtering and manipulating data for analysis	2.5
	Use of regular expressions	2.5

	Applying specialized bioinformatics modules	2.5
Assignments	Python basics and loops	20
	Files, functions and control statements	20
Final Project		20
Final Exam (cumulative)		20
Total		100

Modules of Study

Module	Course Learning Outcomes	Assessments
Basics of Python Programming	1, 5, 7, 8	In-class activities: 1. Variables and data types 2. Python data structures 3. Python standard library and exceptions
Conditionals and Loops	2, 5, 7, 9	In-class activities: 1. Algorithms with loops and conditional statements Assignment 1: Python basics and loops
Introduction to Functions and Modules	2, 6, 8, 9, 10	In-class activities: 1. Creating functions and modules in Python
Reading and Writing Files	1, 2, 3, 6, 7	Assignment 2: Files, functions and control statements
Introduction to Regular Expressions and Data Analysis and Manipulation modules	4, 5, 8, 10	In-class activities: 1. Filtering and manipulating data for analysis 2. Use of regular expressions

Module	Course Learning Outcomes	Assessments
Bioinformatics modules and Plotting	2, 4, 5, 6, 8, 9	In-class activities: 1. Applying specialized bioinformatics modules Final project: Manipulating, visualizing and analyzing bioinformatics data
Error Handling and Data Retrieval	2, 3, 6, 8, 10	Final exam (cumulative)

Required Resources, Tools and/or Equipment:

- NONE

Supplemental Resources:

- Blackboard lectures and assigned resources

Additional Tools and Equipment

- Blackboard lectures and assigned resources

Prior Learning Assessment and Recognition (PLAR)

Students who have prior learning in the material of this course may be eligible for a course credit in recognition of their prior learning. The following table indicates the method that is used to assess prior learning for this course, or it indicates that such an assessment is not available. Students must apply for consideration for a prior learning assessment through the Office of the Registrar, and there is usually a fee associated with the application.

Portfolio	Challenge Exam	Skills Test	Interview	Other (Specify)	Not Available For PLAR
<input checked="" type="checkbox"/>	<input type="checkbox"/>				

Policies and Procedures

It is the student's responsibility to be aware of their obligations under [Humber Policies and Procedures](#).

Academic Regulations

It is the student's responsibility to be aware of the [College Academic Regulations](#). The Academic Regulations apply to all applicants to Humber and all current students enrolled in any program or course offered by Humber, in any location. Information about **academic appeals** is found in the Academic Regulations.

Accessible Learning Services

Humber strives to create a welcoming environment for all students where equity, diversity and inclusion are paramount. Accessible Learning Services facilitates equal access for students with disabilities by coordinating academic accommodations and services. Staff in Accessible Learning Services are available by appointment to assess specific needs, provide referrals and arrange appropriate accommodations. If you require academic accommodations, contact:

Accessible Learning Services: <http://www.humber.ca/student-life/swac/accessible-learning>

North Campus: (416) 675-6622 X5090

Lakeshore Campus: (416) 675-6622 X3331

Academic Integrity

Academic integrity is essentially honesty in all academic endeavors. Academic integrity requires that students avoid all forms of academic misconduct or dishonesty, including plagiarism, cheating on tests or exams or any misrepresentation of academic accomplishment.

Disclaimer

While every effort is made by the professor/faculty to cover all material listed in the outline, the order, content, and/or evaluation may change in the event of special circumstances (e.g. time constraints due to inclement weather, sickness, college closure, technology/equipment problems or changes, etc.). In any such case, students will be given appropriate notification.

Copyright

Copyright is the exclusive legal right given to a creator to reproduce, publish, sell, or distribute his/her work. All members of the Humber community are required to comply with Canadian copyright law which governs the reproduction, use and distribution of copyrighted materials. This means that the copying, use and distribution of copyright-protected materials, regardless of format, is subject to certain limits and restrictions. For example, photocopying or scanning an entire textbook is not allowed, nor is distributing a scanned book.

See the Humber Libraries website (<http://library.humber.ca>) for additional information regarding copyright and for details on allowable limits.