Course list and description

Bioinformatics Core Courses

BIOI 511 Bioinformatics I (3 credits)
BIOI 512 Bioinformatics II (3 credits)
BIOI 513 Bioinformatics III (3 credits)
BIOI 521 Bioinformatics Tools and Databases (3 credits)
BIOI 531 BioProgramming (3 credits)

Computer Science, Mathematics, Biology and Statistics Elective Courses (sample)

COSC 541 Scientific Visualization (3 credits)
MATH 553 Computational Mathematics (3 credits)
MATH 631 Biostatistics (3 credits)
MATH 635 - Computational Linear Algebra (3 credits)

Research and Seminar

BIOI 591 Current Topics in Bioinformatics (3 credits)
BIOI 799 Thesis Seminar in Bioinformatics (3/9 credits)
BIOI 797 Thesis Guidance in Bioinformatics (2 credits) – if needed

Optimal Course Sequence

Year One (First semester)

BIOI 511 Bioinformatics I
BIOI 531 BioProgramming
MATH 631 Biostatistics

Year One (Second Semester)

BIOI 512 Bioinformatics II
BIOI 521 Bioinformatics Tools and Databases
BIOI 591 Current Topics in Bioinformatics

Year Two (First Semester)

BIOI 513 Bioinformatics III
COSC 541 Scientific Visualization
MATH 553 Computational Mathematics

Year Two (Second Semester)
BIOI 799 Thesis Seminar in Bioinformatics 3/9

Year Three (First Semester) (if needed)

BIOI 797 Thesis Guidance in Bioinformatics 2

Course Description

BIOI 511 Bioinformatics I
Three Hours; 3 Credits

The course introduces principles, concepts, methods, techniques, algorithms, tools, and strategies to transform and process the masses of information from biological experiments focusing particularly on sequence data. It covers topics as: DNA and protein sequence alignment and analysis, sequence analysis software, database searching, database search heuristic algorithms, sequence alignment dynamic programming algorithms, RNA folding, and multiple sequence alignment and analysis.

BIOI 512 Bioinformatics II
Three Hours; 3 Credits

The course introduces principles, concepts, methods, techniques, algorithms, tools, and strategies of structural bioinformatics. It covers topics such as: protein structure, DNA and RNA structure, macromolecular structure determination techniques, data representation and databases, comparative features, structure-function assignment, protein interactions, and protein structure predictions.

BIOI 513 Bioinformatics III
Three Hours; 3 Credits

The course is an advanced treatment of various research topics introduced in BIOI.511 and BIOI.512. Bioinformatics techniques applied in functional and comparative genomics such as mRNA expression arrays, studying functions of nonprotein-coding sequences, proteomic techniques to measure the population of proteins in the cell - including mass spectroscopy and protein-based arrays will be covered. The course will also provide an in-depth survey of research involving the applicability and limitations of these approaches.

BIOI 521 Bioinformatics Tools and Databases
Three Hours; 3 Credits

The course introduces bioinformatics tools and databases for processing and management biological data available through the World Wide Web. It covers topics as: bioinformatics tools and databases at the National Center for Biotechnology Information, protein resources at the European Molecular Biology Laboratory, and Biology Workbench at the San Diego Supercomputer Center.

BIOI 531 BioProgramming
Three Hours; 3 Credits

The course introduces programming languages Perl, object-oriented Perl, and BioPerl and presents how to program in bioinformatics. It covers topics as: data types, operators, control structures, functions, regular expressions, files and directories, references, report writing, object-oriented programming, classes, and utility programs for analysis and interpretation of biological structures and data.

COSC 541 Scientific Visualization
Three Hours; 3 Credits

This course introduces principles, concepts, methods, techniques, algorithms, tools and strategies for scientific visualization. It covers the fundamentals of scientific visualization including perception; image techniques and data acquisition; surface extraction; volume visualization; methods for time-varying data; vector visualization; tensor visualization; flow visualization; information visualization; virtual reality; computer animation.

MATH 553 Computational Mathematics
Three Hours; 3 credits

This course covers topics on numerical analysis and methods, computational statistics and linear algebra with application in bioinformatics.

MATH 631 BioStatistics
Three Hours; 3 credits

The course introduces principles, concepts, methods, techniques, algorithms, tools, and strategies of biostatistics. It covers topics as: graphical and numerical descriptive statistical techniques, probability calculations, probability distributions, point and confidence interval estimation, hypothesis testing, correlation, and linear regression.

BIOI 591 Current Topics in Bioinformatics
Three Hours; 3 Credits

This course provides an overview of current research and future directions in bioinformatics. The bulk of this course will deal with disseminating and presenting the most recent articles from various journals relevant to bioinformatics research.

BIOI 799 Thesis Seminar in Bioinformatics
Three Hours; 3/9 Credits

This course covers new trends, topics, and state-of-the art tools in Bioinformatics that are not covered by other Bioinformatics courses. The course focuses on new/emerging areas of interest in Bioinformatics. The course provides guidance and training for thesis research. It gives students opportunities to make presentations of their thesis research and to participate in discussions on current issues and research topics in Bioinformatics.

BIOI 797 Thesis Guidance in Bioinformatics
Two Hours: 2 Credits

This course provides the guidance and details concerning research necessary for posing and solving a thesis problem, writing a thesis, and publishing the thesis results.

Elective Courses

Any Graduate 5xx/6xx course related to the student thesis research for which prerequisites have been completed can be selected as an elective course. The elective course selection should be the result of the student and her/his academic or research advisor mutual agreement.

Thesis

Thesis is a document submitted in support of candidature for the academic degree Master of Science (MS).

A thesis in Bioinformatics usually has theoretical, computational, experimental, and application components.

Thesis reports on a research project or study, or an extended analysis of a topic. Thesis explains the purpose, the previous research literature on the topic of the study, the methods used and the findings of the project. A multiple chapter format is recommended:

- a) an introduction, which introduces the research topic, the methodology, as well as its scope and significance;
- b) a literature review, reviewing relevant literature and showing how this has informed the research issue;
- c) a methodology chapter, explaining how the research has been designed and why the research methods/population/data collection and analysis being used have been chosen;
- d) a findings chapter, outlining the findings of the research itself;
- e) an analysis chapter, analyzing the findings
- f) a discussion chapter, discussing the findings in the context of the literature review and future work
- g) a conclusion

Thesis should be written according the Morgan State University School of Graduate Studies Handbook and Style Guide for Dissertations and Theses. The Handbook includes specific format requirements for the School of Graduate Studies.

Thesis has to be presented to the Thesis Committee and successfully defended at the Thesis Defense open to public. Thesis defense must be announced to the SCMNS community at least 5 working days in advance.