

## GVSU PSM Medical and Bioinformatics Curriculum

### Suggested Course Sequence for Students with Computing Background

#### Start in Fall Semester

Fall Semester- Year One	Credits	Winter Semester- Year One	Credits
CIS 661: Intro to Medical and Bioinformatics (hybrid online or face-to-face)	3	CIS 635: Knowledge Discovery and Data Mining (hybrid online)	3
STA 622: Statistical Methods for Biologists	3	CIS 678: Machine Learning*	3
CIS 500: Fundamentals of Computer Science (background Course) *** -or-	3	CIS 671: Information Visualization	3
CIS 660: Information Management and Science	3	PA 630: Health Administration and Service**	3
<b>Total</b>	<b>6-9(3)</b>	CMB 610: Foundations of Biotech	3
		<b>Total</b>	<b>9</b>
Spring/Summer	Credits		
PSM 691: Internship	4		
PSM 650: Ethics & Professionalism	3		
PSM 662: Seminar in Professional Science	2		
<b>Total</b>	<b>9</b>		
Fall Semester- Year Two	Credits	Winter Semester- Year Two	Credits
CIS 677: High-Performance Computing* -or-	3	CIS 691: Medical and Bioinformatics Capstone	3
CIS 665: Clinical Information Systems**	3	PSM 662: Seminar in Professional Science (if not taken before)	2
CIS 660: Information Management and Science (if not taken before)	3	CIS 678: Machine Learning* -or-	3
CMB 610: Foundations of Biotech	3	PA 630: Health Administration and Service**	3
PA 630: Health Administration and Service** (if not taken before)	3	PSM 650: Ethics & Professionalism (Online - if not taken before)	3
PSM 662: Seminar in Professional Science (if not taken before)	3	CIS 671: Information Visualization (if not taken before)	3
<b>Total</b>	<b>3-9</b>	<b>Total</b>	<b>5-9</b>
<b>Total Credits for the program:</b>	<b>36</b>		

\*Indicates courses required for emphasis in Bioinformatics

\*\*Indicates courses required for emphasis in Clinical Informatics

\*\*\* please see your advisor

Alternative: STA 610 (taught with R, not SPSS) may be taken in place of STA 622 with prior approval by your advisor.

Revised April 2017

**Graduate Course Offerings by Semester**

<b>Fall Courses</b>	<b>Credits</b>	<b>Winter Courses</b>	<b>Credits</b>
CIS 500: Fundamentals of Computer Science	3	CMB 610: Foundations of Biotech	3
CIS 660: Information Management and Science	3	CIS 635: Knowledge Discovery and Data Mining	3
CIS 661: Intro to Medical and Bioinformatics	3	CIS 661: Intro to Medical and Bioinformatics	3
CIS 665: Clinical Information Systems	3	CIS 671: Information Visualization	3
CIS 677: High-Performance Computing	3	CIS 678: Machine Learning	3
CIS 691: Medical and Bioinformatics Capstone	3	CIS 691: Medical and Bioinformatics Capstone	3
CMB 610: Foundations of Biotech	3	PA 630: Health Administration and Service	3
PA 630: Health Administration and Service	3	PSM 650: Ethics & Professionalism	3
PA 635: Hospital Organization and Management	3	PSM 691: Internship	1-4
PSM 650: Ethics & Professionalism	3	STA 610: Applied Statistics for Health Professions	3
PSM 662: Seminar in Professional Science	2		
PSM 691: Internship	1-4		
STA 610: Applied Statistics for Health Professions	3		
STA 622: Statistical Methods for Biologists	3		
<b>Spring/Summer Courses</b>			
PSM 650: Ethics & Professionalism	3		
PSM 662: Seminar in Professional Science	2		

## Graduate Course Descriptions

**CIS 500 Fundamentals of Computer Science** (background Course). Focuses on the advanced programming concepts, common data structures, and basic models that students of Computer Science and Information Systems need to know. Elements of discrete mathematics are integrated through lectures and programming projects. Prerequisite: need overwrite. Contact Program Chair. Three Credits.

**CIS 635 Knowledge Discovery and Data Mining.** A survey of computational methods for knowledge discovery in bioinformatics and medicine. Topics covered are Dynamic Programming (sequence alignment, BLAST search engine), Hidden Markov Models (phylogenetic trees, structure prediction), clustering and discriminations models for micro-array analysis (Gene Expression Data), select data mining software, and working with biological databases. Offered winter semester. Prerequisites: CIS 500 or equivalent. Three credits.

**CIS 660 Information Management and Science.** Intro to information representation, modeling, storage, retrieval, processing, analysis, visualization and science. Topics may include digital libraries, repositories, collections, metadata, databases, ontologies, vocabularies, dictionaries and multimedia, as applied to complex and business, medical humanities and scientific contexts. Prerequisites: CIS 500 or CIS 661. Three Credits

**CIS 661 Introduction to Medical & Bioinformatics.** A survey of fundamental concepts of medical and bioinformatics methods and techniques involved in the integration of computer systems in medical centers and life science industries. Introduction to biomedical information systems; data representation, modeling, management and mining; systems evaluation; project management practices for biomedical decision making. Legal and ethical considerations. Three credits.

**CIS 665 Clinical Information Systems.** Historical development of clinical information systems, including hospital information systems and community health information systems. Topics covered include: clinical information systems and medical informatics, components of clinical information systems, examples of clinical information systems. Offered fall semester. Prerequisites: CIS 661. Three Credits.

**CIS 671 Information Visualization.** Concepts of information visualization, principles in vision and perception, algorithms for building information spaces, and principles of user interface design. Case studies demonstrate information visualization used to solve specific retrieval and decision problems for biological data. Evolution of visual user interfaces and visualization tools, visual information retrieval and knowledge representation. Prerequisites: CIS 500 or equivalent. Three credits.

**CIS 677 High-Performance Computing.** Introduction to parallel and high-performance computing. Coverage Includes modern scalable parallel and distributed architectures, design and analysis of algorithms, communication and synchronization issues, software development environments, and performance evaluation. Case studies include applications in bioinformatics, evolutionary computing, data mining of biological and clinical databases, and knowledge-based systems. Prerequisite(s): CIS 500 or equivalent. Three Credits.

**CIS 678 Machine Learning.** Broad introduction to machine learning computer programs that improve their performance with experience. Topics include decision trees, neural networks, statistical methods, genetic algorithms, Bayesian learning methods, explanation-based goal regression, reinforcement learning, and learning frameworks. Includes an applied machine learning component that provides exposure to established algorithms and machine learning programs. Offered winter semester. Prerequisites: CIS 500 or equivalent. Three credits.

**CIS 691 Medical and Bioinformatics Capstone.** An integrative capstone that synthesizes topics covered in Medical/Bioinformatics. Promotes advanced writing and broad perspectives of issues in contemporary information systems. Students will demonstrate ability to integrate concepts to a practical situation by leading discussion and presenting a paper on a current topic. Offered fall semester. Prerequisites: Completion of Directed Courses in Medical and Bioinformatics. Three Credits.

**CMB 610 Foundations of Biotechnology.** Introduction to the methods and strategies used for the manipulation of biological systems to produce food, drugs, and other products. Topics include experimental systems, gene and protein analysis, genetic engineering, recombinant DNA technology, transgenic organisms, gene therapy, and plant biotechnology. Prerequisites: Admission to a professional science master's program. Three credits.

**PA 630 Health Administration and Services.** Overview of the current management, organization, and delivery of U.S. health care. Current management and organization theories are compared in relation to the health care system. Major system components are defined and studied. Included are discussions of staffing, dealing with internal and external constituencies, and identification of hospital types. Three credits.

**PSM 650 Ethics and Professionalism in Applied Science.** Ethical and professional issues and problems facing practicing scientists. Emphasizes and role of scientists in public and private sectors, their responsibilities, and emerging ethical and professional issues. Offered winter and spring/summer semester. Prerequisites: Admission to a professional science masters (PSM) program. Three Credits.

**PSM 662 Seminar in Professional Science Practice.** Seminar course designed to broaden the student's professional foundation in the practice of applied sciences. Offered Fall and Spring/summer semesters. Two credits. Prerequisites: Admission to a professional science masters (PSM) program. Two Credits.

**PSM 691 Internship.** Full-time or part-time, on-the-job work performed at a sponsoring entity while under the supervision of an approved mentor in an area related to applied sciences. Prerequisites: Satisfactory completion of PSM common core courses and program-specific courses. One to nine credits (4 are required). Offered every semester.