Department of Health Informatics

M.S in Health Informatics

Courses and their Synopses

BINF5005 - Health Care Information Systems (3 Credits)

Students are introduced to a series of health informatics applications including: coding and classification, computer stored patient record system, patient-centered information systems, methods of decision support, hospital information systems, and methodology for information systems. The course stresses general methodology behind all methods and applications: emphasizing design, system components, and data structures and data management. Computer-based information system operation and management functions in the context of various professional settings, impact of information technology on health care management are reviewed and discussed. Particular attention is given to the importance of structuring and managing data using existing and evolving information technology

BINF5006 – Disease Mapping and Surveillance (3 Credits)

Today, information technology has become an integral part of modern health care. Application of health informatics can substantially improve the practice of healthcare – planning, decision analysis and policy-making, management and implementation of medical interventions, and health research. This course focuses on knowledge and skills that are increasingly critical to the modern practice of healthcare. These include use of the technology to quickly and efficiently *collect, organize, analyze, interpret, manage, store, and present (disseminate)* information relevant to healthcare. Particular attention is given to the principles and methods of developing and using disease surveillance systems, geographic information systems, accessing and using various health databases, performing decision analysis, utilizing principles of outcomes research, linking data to healthcare practice and policy, and understanding how consumers gain access to and assess health information. Students are provided hands-on practice in using industry standard software applications (*listed under software resources*), which leads to completion of small projects applicable in various healthcare settings.

BINF5040 – Biomedical Information Processing (3 Credits)

This course introduces theoretical and practical approach of statistic theories to analyze health care data using R programming methods and procedures. This course covers basic R programming including functions, arrays, packages, loops, procedures, and basic statistical tests and models.

BINF5020 - Biomedical Data Science (3 Credits)

The goal of this course is to develop your data science related problem-solving skills for a broad range of healthcare scenarios. Python will be used as the programming environment because it gives all the key elements of a full programming language while also providing access to a large inventory of built-in functions that enable the solution of complex problems within relatively short, well-structured programs. Applied numerical methods will be introduced as a means for solving a wide variety of mathematical problems. The goal is to develop an inventory of standard mathematical and numerical analysis tools and a good understanding of the programming syntax within Python to allow one to use these tools in practical applications. This course should provide you with a variety of practical Python programming and general problem-solving skills for solving data science related problems.

BINF5075 - Biomedical Informatics in Clinical Trials Management (3 Credits)

This course purports to meet the imminent need to educate students and personnel employed in the bio-pharmaceutical sector on the state of art principles and techniques for most effective and efficient management of Clinical Trials data. At the end of the course the student should be able to: - Describe the Clinical Trial Process and define the role of the related departments and personnel in the development of drugs, devices and biologics. - Describe the different means of acquiring Clinical Trial data including the use of Case Report Forms. - Plan and create a Clinical Trial Data Management Protocol document. - Create and use relational databases for the purposes of secure, efficient data storage and retrieval. - Describe the role of CDISC in the Clinical Trial Data Management - Apply the project management techniques such as construction of Gantt chart and Work Breakdown Structure. - Describe and apply different data cleaning techniques for ensuring data quality. - Identify some prescribed procedures for proper reporting of clinical trials.

BINF5100 - Introduction to Biomedical Informatics (3 Credits)

This is an introductory course for MS/PhD degree students in biomedical informatics. This course aims to provide an overview and fundamental knowledge of biomedical informatics. In addition to a bird¿s eye view of the actively evolving field of biomedical informatics, some details of bioinformatics applications in clinical setting are also discussed in this course. Topics covered encompass various areas of biomedical and healthcare informatics, including biomedical modeling, clinical decision support, imaging informatics, public health informatics, pharmacogenomics, clinical proteomics, and metabolomics.

BINF5130 – Controlled Medical Terminology (3 Credits)

Controlled Medical Terminologies (CMTs) are collections of concepts that can be used to unify and consolidate disparate terminologies in the medical domain. CMTs have been used to encode drugs, diagnoses, procedures, etc. They are core components of computer-based tools in the healthcare industry. CMTs play a major role in overcoming terminological differences in the design and integration of computerized healthcare information systems. They are used to reduce healthcare costs, provide better medical services, assess the quality of healthcare providers, and deliver healthcare services more efficiently. Large CMTs have been emerging as important resources for use in medical informatics applications, such as health care management systems, electronic patient record systems, expert systems, and medical information systems. In this course, several major controlled medical terminology systems, such as MeSH, SNOMED, FMA, LONIC, UMLS, and etc., will be introduced. Contents and structures of CMTs will be described in the course. How CMTs are used in health information applications will be discussed.

BINF5210 – Health Data Analytics using SAS (3 Credits)

This course introduces theoretical and practical approach of statistic theories to analyze health care data using SAS programming methods and procedures. SAS will be used to read, write, manipulate, and store the external data in a SAS dataset to perform descriptive and inferential statistics.

BINF5220 – Drug Discovery Informatics and Drug Design (3 Credits)

Topics relevant to the computational aspects of molecular modeling and drug design are discussed with an emphasis on use of the software to carry out these functions. Topics covered include the general principles of modeling small molecules, the use of database searching to facilitate new drug design, the use of the computer in new lead compound discovery and drug design, modeling drug-biomacromolecule interactions, protein structure modeling and prediction, and quantitative structure-function relationship. Didactic material covered in lectures is expanded upon and reinforced by computer laboratory assignments using SYBYL, and students are expected to complete a semester project that should demonstrate students ability to use the SYBYL software on specific applications

BINF5230 – Biomarkers and Personalized Medicine (3 Credits)

This course is focused on computational techniques and statistical analysis of genomics, transcriptomics, and proteomics data in application for drug discovery and translational research. The course seeks to provide students with the fundamental knowledge and skills to approach and solve problems in genome, transcriptome and proteome analysis from a computational perspective using available databases and software. Such analysis is the foundation of biomarker used in personalized medicine and healthcare.

BINF5030 - Visualization in Biomedical Sciences (3 Credits)

Advances in technology have caused an explosive growth in information available in the healthcare field. Because of this growth in recent decades, healthcare professionals need to be well versed in the methods and principles of analyzing and presenting data. According to the National Institutes of Health (NIH), “Data visualization is becoming an increasingly common method of presenting large and complex data sets, but the principles of visual communication are not widely understood or practiced”. This course will provide students with the skills to prepare, analyze, visualize, and communicate with healthcare data using Tableau. These skills are prerequisites for data-driven health fields and prepare students for professional success.

BINF5125 – Machine Learning (3 Credits)

This course will provide an overview of three distinct and state-of-art decision making methodologies: Support Vector Machines (SVM), Artificial Neural Networks (ANN) and Fuzzy Logic. All three techniques will be taught using Python as the development environment. The techniques will be introduced along with several examples from research literature. Although a prior and good knowledge of Python

Programming maybe useful any such required knowledge will be provided in the first few weeks of the course to help facilitate the learning of the rest of the course material.

BINF5311 - Introduction to Electronic Health Records (3 Credits)

In this course, students will learn why Electronic Health Records (EHR) are seen as one of the most effective ways to improve healthcare, what information technology infrastructure is needed to support the EHR, why physician buy-in is essential to achieve success, how to overcome return-on-investment obstacles, the key components of a well-designed EHR, and why clinical decision support offers huge EHR payback. Students will examine how the Electronic Health Record (EHR) will affect clinical outcomes and disease management today and into the future. Students will also get case studies of winning healthcare providers' EHR strategies, tips and tactics that can be used in EHR planning and implementation. In addition, students will learn about the federal government's recent efforts to accelerate EHR adoption and how this adoption will be affected by HIPAA and community security concerns.

BINF5312 - Healthcare Information Processing (3 Credits)

Technological advances have caused explosive growth in the quantity of information available in the healthcare field. A significant amount of valuable data is stored as unstructured text, and effective natural language processing (NLP) methods are needed to accurately interpret and use this data to improve healthcare. This course will give students an introduction to NLP with applications in the healthcare and biomedical domains. Students will develop and evaluate solutions to address specific NLP challenges.

BINF5115 - Health Care Data Management (3 Credits)

This course is designed to introduce the student to practical issues in the management and analysis of biomedical data. In this course, theoretical database design techniques are studied but relational database design (using MySQL and SQL) for healthcare applications will be the primary focus. All students are expected to complete small hands-on projects in a specific area of biomedical informatics.

BINF5131 - Health Care Finance Systems (3 Credits)

The course is designed to provide a balance between theoretical and practical approaches to the financial management of the health care institutions. Emphasis is placed on examples from hospitals to include: preparation of budgets, financial statements and reports, regulation and cost containment, financial analysis and management of health resources. Specific attention is given to rate regulation, hospital reimbursement, hospital accounting, financial ratio analysis, and project evaluation.

BINF5007 – Healthcare Information, Privacy, Security, and Confidentiality (3 Credits)

To provide an overview of HIPAA Privacy Law for the healthcare professionals. Further, to provide a strong foundation of the policy and purpose of HIPAA as it relates to patient care and satisfying the professional obligations of the healthcare provider. Successful completion of this course will provide the necessary foundation of knowledge to allow students to pursue the course of study in all Healthcare careers.

BINF5145 – Diseases and Systems (3 Credits)

This course addresses the need for future health informatics professionals to have a sound basic understanding of the diseases and treatments described by the data they will oversee, process and analyze. Over the semester we will survey human diseases, current clinical interventions, and future directions for diagnosis and therapy. The course is organized first by disease mechanism and then by organ system. It will integrate informatics approaches with a basic understanding of human diseases and current treatments, including evolving medical technologies such as nanomedicine, and how those technologies will impact the diagnosis, evaluation and treatment of medical conditions in the future.

BINF5520 – Health Data Analytics (3 Credits)

This course explores key health analytics and management techniques which healthcare professionals can use data to gain insights and make better management decisions. The course provides an introduction to the basics of health analytics and the importance it serves for data governance programs. The course will utilize data quality improvement techniques that are based on software applications that would typically be found in healthcare organizations, such as Microsoft Excel and SPSS.

BINF5325 – Clinical Decision Support Systems (3 Credits)

This course will provide an overview of concepts, techniques and software pertaining to clinical decision making and decision analysis. Students will learn the application of decision trees to clinical and health care problems, estimation and revision of probabilities; use of artificial intelligence expert systems and decision-making techniques for their implementation as decision support systems in clinical and health information system settings.

BINF5403 – Introduction to Python Programming (3 Credits)

This course introduces theoretical and practical approach of object-oriented language, to structure health care data using Python programming. This course covers basic Python programming including Scripting, Executions, Functions, List, Recursion, Object Oriented programming.

BINF5800 – Internship in Health Informatics (3 Credits)

This course is designed to help the Health Informatics graduate student with career-related work experiences during their degree program. It provides the student with opportunities to make connections between the theory and practice of academic study and the practical application of that study in a professional work environment. Host companies, with a need for health informatics expertise, also gain by acquiring access to short-term, highly skilled interns and thus are able to explore, with very little risk, whether they might have potential matches in such interns as future employees. The term host company or organization as used above and throughout the remainder of this document is intended to mean any private company, government agency, or non-profit organization approved as appropriate by the Program Director to host a MS Health Informatics student intern.

This Internship course counts as equivalent to a required course in the MS Health Informatics degree program. It will further count as a Curricular Practical Training (CPT) pertinent course for F-1 visa International students. Prerequisites: Completion of one academic year of Full Time Study in the program. If the course is sought by International Students for CPT then they should be in lawful F-1 status and enrolled on a full-time basis for at least one full academic year prior to the proposed CPT start date. Secondly they should have an internship position offer. Such students can view more details here: https://global.rutgers.edu/CPT

BINF5515 – Information Governance (3 Credits)

The course provides the foundation and guide for the roles, functions, and practices for successfully managing and integrating enterprise information management and data governance. The course takes an integrative approach to the traditional roles of health information management (HIM), offering challenging opportunities for elevating the practice domain and leveraging the benefits of quality data for the healthcare industry. The course expands on and incorporates data management areas in response to technology innovations, regulatory, efficiency, risk management, and quality.

BINF5900 – Data Science Programming (3 Credits)

This course presents advanced topics in Python for healthcare professionals. It contains sections on libraries, logging, debugging, profiling, and packaging. The course will enable students to write relatively advanced, well structured, computer programs in Python as also become familiar with principles and techniques for optimizing the performance of Python numeric applications.

BINF5513 – Cybersecurity in Healthcare (3 Credits)

Healthcare organizations continually face cyber threats, which put at risk patient privacy and safety. Such threats and breaches also have a significant impact on business continuity and financial health of all healthcare organizations. This course provides a broad overview of all aspects of Cybersecurity pertinent to securing health data in various settings. The student will learn about different ways to improve and maintain cybersecurity, highlighting the interaction between technology and human behavior as also how a positive cybersecurity culture is an important influence on an organization's level of cybersecurity.

BINF5035 – Biostatistics (3 Credits)

This course covers the selection, application, and interpretation of basic statistical tests and procedures used in the health sciences and methods for effective data communication and presentation. Topics include descriptive statistics, statistical inference, procedures associated with basic linear modeling, and nonparametric statistics.

Because this is a statistics course designed for both academic and professional health science degrees, the goal is to provide the student with (a) an introductory exposure to statistical concept and theory (non-mathematical) within the context of healthcare examples, (b) a working knowledge of statistical procedure common in the academic and health-profession research, and (c) experience with a common statistical software package (IBM SPSS).

BINF6000 - Capstone Project (6 Credits)

The Capstone Project is designed to develop the student's ability to provide a contribution to the field of Health Informatics – such as filling an empirical, theoretical, and/or methodological gap. The student will select an appropriate topic and formulate relevant research questions or a developmental methodology, perform literature search, explain the place of their research or project in relation to the health informatics body of knowledge and lastly submit a written report of their project/thesis as per the Department Guidelines. The student will work on the project under the supervision of a Department faculty of his/her choice. The project report should be of such caliber as to warrant publication in a scientific journal or a presentation at a conference.