Courses and Descriptions for the Doctor of Health Informatics (DHI)

BINF5005 - Health Care Information Systems (3 Credits)

The course focuses on the general systems theory applied to health care systems and information technology. 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. Demonstrations of current health information systems, emphasizing design, system components, data structures and database management are conducted. The costs and potential benefits of current applications; the justification, specification and evaluation of computer systems; and the capacity for future modification and development will be reviewed. Students practice on existing systems in various health care settings.

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 MATLAB or Python as the development environment. The techniques will be introduced along with several examples from research literature.

BINF5210 - SAS Applications in Health Informatics (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. Students will also be taught the ways of formulating problems and hypotheses for statistical analysis of clinical, health services, laboratory and biomedical data.

BINF5230 – Translational Informatics and Biomarkers (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.

BINF5100 - Introduction to Biomedical Informatics (3 Credits)

This is an introductory course for MS/DHI degree students in health 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.

BINF5311 - 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.

BINF5000 – Essentials of Health Informatics (3 Credits)

The goal is to provide an in-depth and comprehensive view of HIT by examining healthcare regulatory requirements and the functions of a healthcare organization, including its medical business operations, IT hardware, software, networking, and security.

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.

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.

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.

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.

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; Artificial intelligence expert systems and decision-making techniques for their implementation as decision support systems in clinical and health information system settings. The course will employ the industrial strength Expert System software ExSys CORVID as the teaching and development platform.

BPHE7620 - Scientific Writing for the Translation of Medicine (3 Credits)

Provides foundation for research and communication skills in scientific exchange with an emphasis on evidence based literature search processes, informatics resource instruction (databases, citation managers, excel), an analysis of scientific reviews, synthesis of applicable literature, and diverse strategies for the dissemination of key findings. Principles of engagement in collaboration amongst team environments are also addressed.

BPHE7005 - Pharmacoinformatics (3 Credits)

Provides foundation for advanced knowledge and skills in Pharmacoinformatics with an emphasis on science and service-based opportunities and information resources (drug design databases, adverse event databases, literature databases, and clinical decision support in EHRs), an analysis of scientific literature, and diverse strategies for the dissemination of key findings. Principles of scientific writing are also addressed.

BPHE5310 – Scientific Concepts and Research Design (3 Credits)

Methodology and Practice is designed to teach entry-level graduate students the fundamentals of a good clinical trial in the evaluation of a new drug or device. Phases of drug discovery from bench to market, and a high-level (mostly U.S.) perspective on related regulatory issues are covered. Students learn about the roles of CT stakeholders (patient, sponsor, authorities, investigator, coordinator IRB, DSMB, others) and about trial design fundamentals – especially with respect to Phase 3 basis-of-approval studies. Human subject protection, safety considerations, and literature-searching fundamentals that apply course learnings are stressed. Adaptive trial strategies, epidemiological methods, randomization plans, quality

assurance, treatment masking, business considerations (external funding, budget, cost-effectiveness, other cost-benefit issues), are also touched on.

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.

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.

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.

BINF7510 - Clinical Decision Making and Decision Analysis (3 Credits)

This course provides an in-depth examination of medical applications of AI and rule-based systems. Topics include clinical reasoning and human problem solving, approaches to clinical reasoning and knowledge representation; examination of heuristic programming, artificial neural networks, and knowledge engineering tools in medicine; structured approaches to clinical decision making including Bayes Theorem, decision trees and clinical algorithms

BINF7550 - Medical Image Processing and Visualization (3 Credits)

This course deals with Medical Image Analysis and Visualization Systems built and based on recent advances in computer graphics, image processing, and medical imaging technology currently in wide use in various clinical settings, for a variety of uses (diagnosis, modeling, decision making, education, etc.). Additional topics include: representation of space-time and vector variables, representation of 3-D and higher dimensional data, dynamic graphical methods, and virtual reality. Students are required to work on a visualization project. The course emphasizes software tools such as MATLAB Imaging Toolbox but other software may be used for the projects.

BINF7560 - Health Information Systems Integration (3 Credits)

This course is designed to provide students with methods and tools employed in the design and evaluation of health information standardization activities and integrated health data systems. The students will be able to understand the role health information exchanges (HIEs) between clinical and public health/population health data systems, the main categories of HIT standardization process with its standards, entities, users all employed in the design of information systems at the local, state, regional, national or international levels.

BINF7530 - Health Care Database Management Systems (3 Credits)

The course focuses on advanced database theories and applicable in health management systems. The structure of medical information is examined and its organization into structured knowledge bases is analyzed. All theoretical database design techniques are studied but relational database design for medical application will be the primary focus. Database structure, programming languages, and DBMS with specific software examples are studied. The student is expected to complete a specific health care database management system project, from conception through design to implementation and present as a term project paper.

BINF7570 - Health Care Outcomes Measurement and Research (3 Credits)

This course deals with an overview of public health outcomes measures and research will be provided including epidemiological and quality improvement measurement factors, and statistical methods. The course will also provide examples and study of clinical outcomes applications including subjective and objective outcomes assessment tools, current outcomes initiative and trends, risk adjustment, severity, validity and reliability.

BINF7600 – Seminar on Representations and Algorithms in Biomedicine (3 Credits)

In this course a student will formulate a doctoral project research question and develop a brief project description that presents the study aims, scientific background, significance and methods for carrying out the dissertation project. The student will have to make an oral presentation at the Department Colloquium Event and/or Work in Progress school seminars by preparing a set of slides describing the critical components of the design, data collection, and data management procedures of the doctoral project.

BINF7520 – Clinical Data Analysis and Predictive Techniques (3 Credits)

In this course students will learn various mathematical modeling and simulation techniques utilized in clinical situations that facilitates effective decision making. Understanding the nature of these modeling techniques will help students to formulate, assess and evaluate the appropriateness of their use in health informatics projects. Utilization of data for outcomes-based patient management to improve patient and outcomes management, enhance outcomes and reduce costs. Students will also be exposed to an overview of public health outcomes measures and research, including epidemiological and quality improvement measurement factors, and statistical methods.

BINF7700 – Literature Review (3 Credits)

The focus of this independent study course is to develop graduate-level critical thinking skills via using research methods to locate and record accurate, valid information relevant to an informatics research project; be able to judge the value of the information including distinguishing between primary and secondary sources; effectively synthesize source information into writing with the use of quotes, paraphrasing and summarizing; use a standard research documentation format in a completed research paper for publication in a peer-reviewed journal and/or presentation at a conference.

BINF7540 – Health Research Methods (3 Credits)

This course provides a comprehensive overview of the concepts and practice of health research. The student will come away with an impressive portfolio of skills: conceptualizing a problem, searching relevant literature, reviewing procedures, compiling data, drawing conclusions from statistical analyses, relating findings to existing literature, and communicating them to an audience. Importantly, they will also be introduced to the process of writing peer review manuscripts, good research conduct and preparing and submitting grant applications.

BPHE6700 – Special Topics in Clinical Trials (3 Credits)

This course will present a collection of the most timely and momentous topics affecting the pharmaceutical industry presented by members of the Biopharma faculty and guest speakers. Each topic is expected to be covered in one week, but may extend into a second week. Given that this course will often follow the news and current events, the topics will not always be known ahead of time during the registration period. However, a cadre of topics may include the following: essentials for data quality, project management, and current/proposed trial designs and data analytics in clinical research.

BINF8001, 8002, 8003 – Doctoral Project (18 Credits)

The Doctoral 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 should demonstrate, through his/her **written project report** an ability to plan, conduct, and present an investigation of relevance to the chosen area of specialization track.