Biomedical Informatics

BMI 501: Introduction to Biomedical Informatics
This course introduces the unique characteristics of clinical and life science data and the methods for representation and transformation of biomedical data, information, and knowledge to improve human health. The course will provide an overview of basic concepts and will serve as a Launchpad into other more focused courses that explore the computational and analytics needs of BMI, as well as the clinical, research and translational applications of informatics. There will be three major themes: Information representation, management and sharing; biomedical data representation and management; standards, terminologies, and ontologies such as HL7, IHE, SNOMED, ICD-9; Privacy, confidentiality and data sharing. Clinical Informatics: Health care environment and processes; electronic health records and management; clinical decision making clinical information retrieval clinical natural language processing. Imaging informatics: radiological image modalities; DICOM and PACS systems; computer-aided diagnosis; digital pathology; analytical pathology imaging. This course will provide hand-on assignments for the participants to familiarize the concepts. Prerequisite: Graduate standing in BMI or permission of instructor.

3 credits, Letter graded (A, A-, B+, etc.)

BMI 502: Life Sciences for Biomedical Informatics
This course presents the fundamentals of human cell biology, biochemistry, genetics and cell/organ physiology. The biochemical and molecular bases of cell structure, energy metabolism, gene regulation, heredity, and development are discussed, as are the structure and function of cell membranes and the physiology of cell to cell signaling, cellular respiration, and homeostasis of organs and individuals. Can be used for credit toward masters or doctoral degree in BMI only with permission and NOT in addition to BMI 503. Can NOT be used for credit toward certificate in Biomedical Informatics.

3 credits, Letter graded (A, A-, B+, etc.)

BMI 503: Computer Science for Biomedical Informatics
This course presents the fundamentals of computer science and problem solving for computer programming. Students learn how computers store and manipulate data using programming languages and algorithms and how computers are controlled by operating systems and networked. Software engineering, data abstractions, and database management systems are described. Applications include computer graphics and artificial intelligence. A theory of computing is presented. Approaches to devising solutions to problem are discussed. Structured programming tools are presented including sequential and decision logic and loops. Data and file operations are explained including processing arrays, sorting, stacks, queues, linked lists, and binary trees. Object-oriented programming and sequential file applications are discussed. Can be used for credit toward masters or doctoral degree in BMI only with permission and NOT in addition to BMI 502. Can NOT be used for credit toward certificate in Biomedical Informatics.

3 credits, Letter graded (A, A-, B+, etc.)

BMI 511: Translational Bioinformatics
This course will provide students with an integrative computational toolbox at the intersection between Biomedical and Quantitative Sciences. Students will develop storage, analytic, and interpretive methods to optimize the transformation of large biomedical and genomic datasets, into proactive, predictive, preventive, and participatory health information. Applying a working knowledge of Computational Statistics in a Biomedical/Biomolecular context, students will gain the ability to integrate those Computational Tools and Big Data resources in the Biomedical research enterprise as well as in the clinical workflow. Accordingly, this course will familiarize the participants with the data processing methodologies associated with a range of biological signals that spans from Biological sequences to Histology images, and from mining medical records to Genome Wide Association Studies (GWAS) and gene prioritization.

3 credits, Letter graded (A, A-, B+, etc.)

BMI 520: Data Analytics and Software Stacks
This course will cover cutting-edge data analytic applications, infrastructure, and analytic methods. Students will have the opportunity to analyze real (de-identified) healthcare datasets and spatio-temporal and molecular datasets drawn from cancer research. Each class session will include discussions of applications, infrastructure, and algorithms. Students will present papers, and there will also be guest lectures from visiting experts. Students will attend lectures, present and critique papers, and work with a team of students on a substantial project throughout the semester. Students are expected to demonstrate a high level of independence, critical thinking, and initiative.

3 credits, Letter graded (A, A-, B+, etc.)

BMI 530: Software Development in Biomedical Informatics
This is an advanced topic in the BMI series, designed for participants with plans to develop Biomedical Informatics software applications. The BMI530 course is divided in two parts.
The first part will provide an overview of approaches to software development in a Biomedical context, where reproducibility, governance and availability are particular concerns. The participants will be introduced, hands-on, to practices such as the use of version control services (such as GitHub), collaborative development models (such as agile programming, extreme programming, unit testing, continuous code review, pair programming etc) and software architectural patterns (such as Model-View-Controller, MVC, and Model-View-Adapter, MVA).

The increasing reliance on Cloud Computing infrastructure and Web 3.0 technologies for both software development and deployment will be object of particular attention. The increasing reliance on Big Data resources in Biomedicine, and the broadening use of Web Computing will be approached as part of the exercise of configuring class projects for the second part of the course. Accordingly, a particular focus will be put on the use of Representation State Transfer (REST) architectures and hands-on familiarization with REST APIs (Application Programming Interfaces). The second part of the course will put these concepts into practice through the development of small software projects. Groups of one to three people per project development team will be configured to develop software that solves problems brought to the class by the participants, preferably, but not necessarily, as contributions to manuscripts and/or funded research. Prerequisite: BMI 503 and programming experience, BMI 520, or permission by instructor (face-to-face meeting required).

3 credits, Letter graded (A, A-, B+, etc.)

BMI 552: Quality Improvement Methods for Clinical Informatics
Teaches health care management professionals how to perform improvement projects and incorporate quantitative measurement into daily work routines to form the foundation for a quality improvement-oriented culture. Using Minitab software, provides strategies for a quality improvement-oriented culture. Must have the approval of the Research and Directed Study Committee of the Department of Biomedical Informatics prior to registration. Prerequisite: Graduate standing in BMI, or permission by instructor (face-to-face meeting required).

1-3 credits, Letter graded (A, A-, B+, etc.) May be repeated for credit.

BMI 550: Independent Study in Biomedical Informatics
Independent study in Biomedical Informatics. Must have the approval of the Research and Directed Study Committee of the Department of Biomedical Informatics prior to registration. Prerequisite: Graduate standing in BMI, or permission by instructor.

1-3 credits, Letter graded (A, A-, B+, etc.) May be repeated for credit.

BMI 591: Independent Reading in Biomedical Informatics
Supplementary specialized readings in Biomedical Informatics for graduate students under faculty supervision. Must have the approval of the Research and Directed Study Committee of the Department of Biomedical Informatics prior to registration.

1-3 credits, Letter graded (A, A-, B+, etc.) May be repeated 1 times FOR credit.

BMI 592: Biomedical Informatics Masters Pre-Candidates Seminar
This course is designed to expose students to current research and other topics in Biomedical Informatics. Speakers are invited from both on and off campus.

1 credit, Letter graded (A, A-, B+, etc.)

BMI 595: Special Topics in Biomedical Informatics
Examination of special problems in Biomedical Informatics, by one or more members of the faculty.

1-6 credits, Letter graded (A, A-, B+, etc.) May be repeated for credit.

BMI 596: Special Problems in Biomedical Informatics
Accordingly, the clinical decision support systems (CDSS) being developed for clinical pharmacogenomics, specifically those that establish pharmacotyping in drug prescription, will play a central role in this course. Its content will cover innovative drug formulations and nanotheranostics, molecular imaging and signatures, medical genomics, translational nanomedicine and informatics, stem cell therapy approaches, modeling and predictability of drug response, pharmacogenetics-guided drug prescription, pediatric drug dosing, pharmacovigilance and regulatory aspects, ethical and cost-effectiveness issues, pharmacogenomics knowledge bases, personal genome sequencing, molecular diagnostics, as well as information-based medicine.

3 credits, Letter graded (A, A-, B+, etc.)

BMI 692: Biomedical Informatics Candidates Seminar
This course is designed to expose students to current research and other topics in Biomedical Informatics. Speakers are invited from both on and off campus.

1 credit, Letter graded (A, A-, B+, etc.)

BMI 699: Independent Study-Off Campus
Examination of special problems in Biomedical Informatics, conducted jointly by graduate students and one or more members of the faculty.

1-6 credits, Letter graded (A, A-, B+, etc.) May be repeated for credit.

BMI 700: Dissertation Research-Off Campus, Domestic
Independent research conducted off campus, in the United States, under the supervision of a Biomedical Informatics faculty member in support of the Ph.D. Dissertation. Permission to register requires the agreement of the faculty member to supervise the research. May be repeated.

1-12 credits, Letter graded (A, A-, B+, etc.) May be repeated for credit.

BMI 701: Dissertation Research-Off Campus, International
Independent research conducted off campus, outside the United States, under the supervision of a Biomedical Informatics faculty member in support of the Ph.D. Dissertation. Permission to register requires the agreement of the faculty member to supervise the research. May be repeated.

1-2 credits, Letter graded (A, A-, B+, etc.) May be repeated 1 times FOR credit.