New York City College of Technology
School of Arts and Sciences
Department of Biological Sciences

MEDICAL INFORMATICS FUNDAMENTALS (MED 2400) SYLLABUS

Course Information

Course Title: Medical Informatics Fundamentals
Course Code: MED 2400
Credits Hours: 3 credit hours. 3 hours lecture per week
Prerequisite: BIO 2311

Course Description: An introduction to the current practice of medical informatics. Major course topics address challenges related to the implementation of electronic health records (EHR) and other medical and healthcare databases in patient care settings, and their effective use in managing and improving personal and public health. Related topics include acquisition, storage, use and representation of medical data; medical terminology and associated databases; health information management and retrieval methods; privacy and security of health data; evidence-based medicine; and a survey of ethical, legal, and political issues at play in the technological shifts in the field of medical informatics.
Additional Suggested Reading: Lecture notes, journal articles, and other reading materials provided by the instructor.

Course Coordinators

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Extended Course Description

This course provides a full introduction to the issues involved in the current practice of medical informatics. Major course topics address challenges related to the implementation of electronic health records and other medical and healthcare databases in patient care settings, and their effective use in managing and improving personal and public health. Through timely examples and real-life case studies, students will understand medical informatics as a critical component of the practice of medical care and public health. Topics covered in the semester include acquisition, storage, use and representation of medical data; medical terminology and associated databases; health information management and retrieval methods; privacy and security of health data; electronic health records (EHR); evidence-based medicine; and a survey of ethical, legal, and political issues at play in the technological shifts in the field of medical informatics.

Anticipated Learning Objectives

Upon satisfactory completion of the course, the student will be able to:
1. describe how the healthcare information infrastructure is used to collect, process, maintain, exchange, and disseminate data.
2. demonstrate familiarity with information systems that employ communication and computer technology to collect, maintain, access, evaluate, and interpret healthcare/public health data.
3. demonstrate understanding of the use of informatics methods and resources as strategic tools to improve healthcare delivery and public health.
4. articulate the importance of collaboration among medical, public health, communication, and informatics specialists in the process of design, implementation, and evaluation of healthcare/public health programs.
5. articulate legal and ethical principles fundamental to the use of information technology and resources in healthcare/public health settings.
6. explain issues of privacy, confidentiality, and security of medical data in the context of an electronic information infrastructure.
7. demonstrate effective written and oral skills for communicating with different audiences in the context of professional healthcare/public health activities.

**Gen Ed Learning Outcomes**

Students in this course will:

a. expand and deepen their knowledge by:
   i. learning to value knowledge and learning;
   ii. understanding and appreciating the range of academic disciplines that constitute the interdisciplinary field of medical informatics, and comprehending their relationships in this field of study;
   iii. using this course as a forum for the study of values and ethical principles that are at play in the rapid
development in the field of medical informatics, as well as for the study of applied medical sciences that inform the physical world.

iv. engaging in an in-depth, focused, and sustained program of study of medical informatics; and

v. acquiring tools for lifelong learning, such as the proper and efficient ways to utilize existing scientific and medical data and information to gain knowledge.

b. acquire and use tools needed for communication, inquiry, analysis, and productive work by:

i. communicating effectively using written, oral, and visual means; and

ii. understanding and employing quantitative and computational analysis to describe medical informatics problems, both independently and cooperatively;

c. work productively within the diverse discipline of medical informatics and related fields by:

i. gathering, interpreting, evaluating, and applying information discerningly from a variety of sources, as displayed in their final research projects;

ii. understanding and navigating complex systems that support research and practice in medical informatics; and

iii. resolving complex issues creatively by employing multiple sources of information, systems, and tools.

d. understand and apply values and ethics in personal and professional domains by:

i. demonstrating intellectual honesty and personal responsibility;

ii. demonstrating intellectual agility;

iii. working in teams effectively; and

iv. transforming biomedical information into knowledge.
CUNY Flexible Core Learning Outcomes

Students in this course student will:

1. identify and apply fundamental concepts and methods of biomedical and informatics sciences to explore the scientific world;
2. demonstrate how tools of medical informatics and computational technologies to analyze problems and develop solutions;
3. articulate and evaluate the impact of biomedical and computational technologies and biological discoveries on the contemporary worlds, such as issues of personal privacy, security, and ethical responsibilities; and
4. understand scientific principles underlying matters of policy or public concern in which science plays a role.
### Assessment of Specific Learning Outcomes

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<thead>
<tr>
<th>LEARNING OUTCOMES</th>
<th>ASSESSMENT</th>
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<tr>
<td>Use proper terminology related to information systems used to collect, maintain, and access medical data.</td>
<td>Quizzes and exams that are given throughout the semester.</td>
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<tr>
<td>Articulate the need for standard and controlled terminology in the digitization of clinical and biomedical data.</td>
<td>Quizzes and exams that are given throughout the semester.</td>
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<td>Describe information systems in current use in medical and public health centers and how they are used in practice.</td>
<td>Multiple-choice and short-answer quizzes; essay-type answer exams.</td>
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<tr>
<td>Discuss the history and development of the Electronic Health Record (EHR), the parts of the EHR, and its current and intended use in healthcare settings.</td>
<td>Short-answer quizzes and essay-type answer exams.</td>
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<tr>
<td>Articulate the need for, as well as issues relating to, EHR in the delivery and quality of healthcare.</td>
<td>Quizzes and exams that are given throughout the semester.</td>
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<tr>
<td>Compare health information systems in different clinical settings (i.e., hospital, clinic, laboratory, radiology, and pharmacy), and describe the</td>
<td>Multiple-choice and short-answer quizzes; essay-type answer exams.</td>
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<td>Common and unique features of each.</td>
<td>Discuss the ways in which health information systems contribute to the improvement of public health.</td>
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<td></td>
<td>Short-answer quizzes and essay-type answer exams.</td>
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<td>Describe the processes involved in health finance and insurance systems, and discuss the issues involved in health insurance.</td>
<td>Short-answer quizzes and essay-type answer exams.</td>
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<td>Explain how bioinformatics and biomedical informatics can assist in biomedical research.</td>
<td>Short-answer quizzes and essay-type answer exams.</td>
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<td>Identify ways in which data mining of biological and health record databases can improve healthcare.</td>
<td>Multiple-choice and short-answer quizzes; essay-type answer exams.</td>
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<td>Describe the impact of health informatics technologies on clinical decision making.</td>
<td>Short-answer quizzes and essay-type answer exams.</td>
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<td>Participate in an informed discussion and debate about the ethical issues relating to the EHR and other public health information technologies.</td>
<td>Short-answer quizzes and essay-type answer exams; evaluation of online Discussion Board forum participation; class participation.</td>
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<tr>
<td>Discuss the legal ramifications of the use of EHR and associated data in healthcare delivery.</td>
<td>Short-answer quizzes and essay-type answer exams; evaluation of Discussion Board forum participation.</td>
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<td>Task</td>
<td>Assessment</td>
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<tr>
<td>Explain the political issues (both domestic and international) at</td>
<td>Short-answer quizzes and essay-type answer exams; evaluation of Discussion Board forum participation; class participation.</td>
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<td>play in mandating EHR use.</td>
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<td>Identify new and emerging informatic technologies that could</td>
<td>Multiple-choice and short-answer quizzes; essay-type answer exams.</td>
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<td>transform healthcare in the future.</td>
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<td>Design a project report plan and formulate appropriate scientific</td>
<td>Evaluation of Research Project Worksheets to track progress of research work.</td>
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<td>questions to be addressed in the project.</td>
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<td>Efficiently use online and library resources to gather appropriate</td>
<td>Evaluation of Research Project Worksheets to track progress of research work; evaluation of semester-long research project.</td>
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<td>information sources, and incorporate these in a coherent written</td>
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<td>report.</td>
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<td>Be able to express complex scientific ideas and social issues orally,</td>
<td>Evaluation of oral report of the class project; instructor evaluation of class participation.</td>
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<td>in a clear and critical manner.</td>
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<tr>
<td>Incorporate many health informatics and bioinformatics topics</td>
<td>Evaluation of Research Project Worksheets to track progress of research work; evaluation of semester-long research project.</td>
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<td>covered in class into a coherent final project.</td>
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# Topical Lecture Outline

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<th>WEEK</th>
<th>TOPIC</th>
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<tr>
<td><strong>1</strong></td>
<td><strong>PART 1: Themes in Medical Informatics</strong></td>
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| | **UNIT I: What is Medical Informatics?**  
| | • The Goals of Medical Informatics  
| | • A Brief History of Medical Informatics  
| | • The Organization of Medicine and Healthcare  
| | • Systems Design Considerations for the Clinical User |
| **2** | **UNIT II: Controlled Medical Terminology**  
| | • A Taxonomy of Medical Informatics  
| | • Standards in medical informatics  
| | • MeSH (Medical Subject Headings) |
| **3** | **UNIT III: The Electronic Health Record (EHR)**  
| | • UMLS (Universal Medical Language System)  
| | • Specific systems including ICD9, SNOMED, LOINC  
| | • Adverse Drug Reaction Terminology, RxNORM and OMIM  
| | • Case Studies |
| **4** | **EXAM 1** |
| **5** | **UNIT III: The Electronic Health Record (EHR)**  
| | • Issues with EHR  
| | • History, Organization  
| | • Case Studies  
| | • Current Projects and Latest Technologies  
| | • Impact on Quality of Care |
Part II: Medical Informatics and Health Information Systems

UNIT IV: Health Information Systems in Clinical Settings
- Hospital Information Systems
- Clinic Information Systems
- Laboratory Information Systems
- Radiology Information Systems
- Pharmacy Information Systems

UNIT V: Health Information Systems in Public Health
- Disease Surveillance (NEDSS)
- Chronic Disease Management
- Disease Registries
- Epidemiology

EXAM 2

UNIT V: Systems for Health Finance and Health Insurance
- Methods of Payment
- Payer-side systems
- Provider-side systems
- Managed Care and Managed Costs
- Case Studies

Part III: Applications of Medical Informatics and Related Issues

UNIT VI: Informatics Issues in Virtual Healthcare, Telemedicine, and Expert Systems
| 11 | • eHealth  
• Virtual Healthcare Delivery System  
• Issues in Telemedicine: Real-time, Store-and-forward |
| 12 | • Artificial Intelligence in Medicine  
• Expert Systems in Medicine |
| 13 | UNIT VII: Medical Informatics and Clinical Decision Making  
• Measuring Quality and Outcomes  
• Standards and Quality Improvement  
• Evidence-Based Medicine  
• Case Studies |
| 14 | UNIT VIII: Ethical, Legal, and Political Issues (HIPAA)  
• Accessibility vs. Confidentiality  
• Health as a Human Right  
• Laws Relating to Healthcare  
• Ethical Use of Medical Data for Public Health Research  
• Case Studies |
| 15 | UNIT IX: Future Technologies  
• Integrating the Personal Health Record with Mobile Technology  
• Personalized Medicine  
• Genome-based Medical Care  
• Various readings from current literature on future trends |

**Project Presentations**  
**FINAL EXAMINATION**  

**Grading Procedure**
Student scores from quizzes (15%), take-home (online) assignments (15%), final class project and presentation (15%) (see details below), class participation (both in-class and online) (5%), and four exams (50%), including one comprehensive final exam, will constitute the final grade.

**Research Project and Class Presentation**

The research project, which accounts for 15% of the final grade, involves: (1) a formal write-up of at least 5 pages (*not* including the cover page), using 1.5 line spacing (*not* double spaced); and (2) a 8-10 minute oral presentation in class. Class presentations will be held on the last week of the semester, and the written reports will be due on the last class meeting.

A list of suggested topics of current interest in medical informatics will be provided. However, students are encouraged to explore other topics outside the list. Students will discuss their research topic with the instructor by Week 10 of the course. During the succeeding weeks, students will be expected to accomplish 3 Research Project Worksheets, designed to guide them through the many steps of organizing a comprehensive research project and oral presentation.

**Class Participation**

Participation is key to making everyone’s experience pleasant and productive. Participation means not only that the student be present in class (or online), but also that the student should:

- review all course sections and complete all weekly assignments on a timely basis;
- fully cooperate and collaborate with classmates in group work assignments and exercises.
• actively and interactively participate in each lecture’s discussion in the classroom and online. This requirement applies to students whether they are taking the course online (fully or partially online) or face to face.