

BMI 503: Biomedical Informatics Systems, Databases and Software Methods

Course Information

Date/Time: Mo 12pm-3pm
Location: BMI-506
Credits: 3
Instructor: Dr. Jaroslaw Zola
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Course Description

This course provides Biomedical Informatics graduate students and clinical fellows with a technical overview of the current computing and information technology systems, programming languages and software development tools available to manage, access and analyze health and biomedical data. The systems are presented in the context of effective patient care as well as research settings.

Course Organization

The course will consist of a series of lectures complemented by a practical demonstrations and exercises. The course outline is provided below. Note that the course content is usually adjusted to meet students' requests, and hence it may sometimes diverge from what is below.

- **Introduction** A broad overview of computing and information technology systems in health care and biomedical research settings, their role, function, benefits and challenges (3 lectures).
- **Computer and Network Architectures for Health Care and Biomedicine** Organization of computer systems from mobile devices to large-scale data centers – hardware and operating system view. Practical exercises using Linux operating system (3 lectures + 3 laboratories).
- **Cloud Computing For Biomedical Research** Concepts of Infrastructure as a Service (IaaS), Platform as a Service (PaaS) and Software as a Service (SaaS). Data warehouses for biomedical research (6 lectures).
- **Health Care and Biomedical Database Systems** Relational and object databases for medical data. Data types, their representation and storage. Data integration and exchange. Practical exercises with SQL, XML, JSON and FHIR standards and SMART platform. (9 lectures + 3 laboratories).
- **Biomedical Systems Security and Data Confidentiality** Common risks and mitigation techniques in biomedical systems security, concepts of encryption, virtualization, authentication and authorization. (3 lectures).

- **Data Analytics for Medical and Health Care Data** Introduction to Python and R and their related libraries. Statistical and machine learning data analysis and processing. Practical exercises using publicly available data. (9 lectures + 3 laboratories).

Student Learning Outcomes

Upon completion of the course you will gain:

- Basic understanding of how computer systems and networks are organized and used in the context of biomedical and health care applications.
- Proficiency in using basic methods to access, retrieve, store and analyze different biomedical data types.

Course Requirements

The course has three requirements:

1. Class attendance and participation in in-class discussions – you will be expected to read assigned material, for example journal papers, and actively engage in discussion with instructor and other students.
2. Laboratory exercises – each course section will be complemented with graded hands-on practical exercises testing practical aspects of the covered material.
3. Final exam – the course will be concluded with open books/open notes final exam testing your knowledge from all covered topics.

Grading Policy

The final grade will be weighted average: 10% class attendance and participation, 45% laboratory exercises, 45% final exam. The number-to-letter grade mapping will be done as indicated in the table below:

Percentage score	Grade	Quality points
90-100	A	4.0
85-89	A-	3.67
80-84	B+	3.33
75-79	B	3.0
70-74	B-	2.67
65-69	C+	2.33
60-64	C	2.0
55-59	C-	1.67
50-54	D	1.0
0-49	F	0.0

In general, no incomplete grades (I) will be given. However, in special circumstances that are truly beyond student's control and justify incomplete grade, we will follow the university policy on incomplete grades, available at: <https://grad.buffalo.edu/succeed/current-students/policy-library.html>.

Course Materials

This course does not rely on one specific textbook. However, the following book is suggested (but not required) as a complement to the lectures' content:

- "Biomedical Informatics, Computer Applications in Health Care and Biomedicine, 4th Edition"
E.H. Shortliffe, J.J. Cimino (Eds.), Springer, 2014.

Additional online materials might be referenced/provided during the course and will be available from the course web site.

Academic Integrity

You should be familiar with the university policies on academic integrity, available at:

<https://grad.buffalo.edu/succeed/current-students/policy-library.html>.

Any violation of these policies, including but not limited to cheating on any course deliverables, will result in automatic failure of the course.

Accessibility Resources

If you have any disability which requires reasonable accommodations to enable you to participate in this course, please contact the Office of Accessibility Resources, 25 Capen Hall, Phone: (716) 645-2608, and also the instructor of this course. The office will provide you with information and review appropriate arrangements for reasonable accommodations.