BME/SIE 477|577: Introduction to Biomedical Informatics

Instructor: Vignesh Subbian, PhD | E-mail: vsubbian@arizona.edu
Class Time: Online. All course materials will be administered through D2L. Office hours will be held via Zoom as needed.

Course Catalog Information: (3 credits)
BME/SIE 477/577: Driven by efforts to improve human health and healthcare systems, this course will cover relevant topics at the intersection of people, health information, and technology. Specifically, we will survey the field of biomedical informatics that studies the effective uses of biomedical data collected *from* individuals (patients) and populations *for* scientific inquiry, problem solving, and decision making. We will explore foundations and methods from both biomedical and computing perspectives, including hands-on experiences with systems, tools, and technologies in the healthcare ecosystem.

Prerequisites: A basic course in computing or computer applications (ECE 175, CSC 127A, or equivalent) or consent of the instructor is required for undergraduate students. Pre-med students, undergraduate and graduate students in biomedical, computer, electrical, systems, and industrial engineering, computer science, statistics, applied math, health law, clinical and translational sciences, and information sciences are welcome.

- If you are an undergraduate student in the College of Engineering, you must be granted *advanced standing* to enroll in this course.
- If you are a student/trainee from outside of the College of Engineering, please talk to the instructor to discuss your interests and obtain consent to enroll.

Course Reference Textbooks:
- Shortliffe, E. H., Cimino, J. J., and Chiang, M (2021). Biomedical Informatics: Computer Applications in Health Care and Biomedicine. Springer Science & Business Media, (5th Edition).
- Selected readings from peer-reviewed literature in biomedical informatics, translational medicine, and healthcare systems engineering.

Course Topics:
This is a tentative list of topics. Some modules are subject to change.
Part I: Foundations and Themes
1. The Science and Pragmatics of Biomedical Informatics
2. Acquisition, Storage, and Use of biomedical data (including “big data”)
3. Standards in Biomedical Informatics
4. Biomedical Decision Making
5. Natural Language Processing in Health care and Biomedicine
6. Ethics in Biomedical and Health Informatics
7. Introduction to Methodologies in Biomedical Informatics

Part II: Applications
8. Bioinformatics and Translational Bioinformatics

9. Biomedical Imaging Informatics
10. Clinical Informatics and Electronic Health Record Systems
11. Clinical Research Informatics
12. Public Health Informatics

Part III: Trends

13. Evidence-based Practices, Technology-related Policies in Healthcare
14. Emerging Technologies and the Future of Informatics in Biomedicine

Course Learning Outcomes:

At the end of this course, each trainee/student will be able to

- Understand the different sub-disciplines of biomedical informatics (BMI) and identity an area of interest for further study, research, and/or practice (ABET outcome: 2, 3).
- Comprehend how to acquire, store and maintain, retrieve, analyze, and meaningfully use biomedical data (ABET outcome: 6).
- Apply biomedical and computational tools and technologies to solve problems in biomedicine and healthcare (ABET outcome: 1, 2, 5, 6).
- Understand how technology, including health information systems and medical devices, can improve or limit the ability to provide clinical care (ABET outcome: 1, 3).
- Critically think and develop own perspectives on ethical and legal considerations in use of contemporary technology and informatics in health care (ABET outcome: 3, 4).

For BME/SIE 577 only: In addition to the above outcomes, graduate students will be able to

- Identify, understand, and interpret evidence from biomedical informatics literature/research.
- Conceptualize and utilize informatics-based tools in one of the sub-disciplines for clinical practice, research, or policy-making.

Assessment of Learning

Projects (50%)

Students will work in (virtual) teams of two in a mentored semester-long project with multiple design iterations. This project will involve identification of a topic and problem of interest in one of the informatics sub-disciplines, systematic review of literature pertinent to the problem, and producing a data product using an engineering design process. **For BME/SIE 577 only**: Students registered for graduate credit will have additional research objective(s) as a part of their project.

Biweekly assignments (40%)

There will be around 3-4 biweekly assignments during the first half of the semester. Assignments will involve hands-on, informatics-related exercises. A detailed write-up will be posted for each assignment. **For BME/SIE 577 only**: Students registered for graduate credit will have an additional lab assignment.

Reflection Activities (Quizzes) (10%)

There will be an online reflection activity (quiz) at the end of every week to assess conceptual understanding of informatics topics.

Assessment Scale:

The final letter grade will be based on UA's standard grading scale and assigned as follows. The minimum overall total (lower limit) may be lowered, but will not be raised.

A: 90 to 100 | B: 80 to 89.99 | C: 70 to 79.99

D: 60 to 69.99 | E: 0 to 59.99

Course Policies

- **Team Work:** For team projects, students are required to work on (virtual) teams of two. Team sizes of more than two will be allowed, if the project scope requires additional expertise or resources. Students' background and prior experience will be used to form teams. Every member of the team is expected contribute equally to the project. The entire team will share the same score for each release; however, if the instructor/members identify others who have not contributed (or have contributed above and beyond), the scores will be varied accordingly.
- **Extra Credit:** Extra credit opportunities (if any) will be announced in class.
- **Submission Policies:** All submissions are due on the day and time specified on D2L (usually, noon on Mondays). Late submissions will receive 85% credit after the due date. Late submissions beyond one week after the due date will receive 10% credit.
- **Academic Integrity:** Every student/student team should strive for honest and responsible conduct. All forms of academic misconduct including, but not limited to, plagiarism, unauthorized collaboration, and fabrication are strictly prohibited. Failure to adhere to these guidelines will be dealt with as recommended in the UArizona Student Code of Conduct and the submission/activity under consideration will receive 1% credit.
- **Grievance Policy**: All course-related grievances should be communicated in writing via e-mail.
- **Statement of Changes to Syllabus**: Information contained in this course syllabus, other than the grading policy, may be subject to change with advance notice, as deemed appropriate by the instructor.