**Syllabus: BMED 2300, Bio-Imaging and Bio-Instrumentation** (updated 1/1/2025)

**Credits and contact hours:** 4 credits, 4 contact hours

**Instructor and Coordinator:** Ge Wang, Hisham Mohamed

**Textbook(s):** Introduction to Biomedical Imaging. Andrew Webb. IEEE Press series in Biomedical Engineering, 1st or 2nd edition.

**Supplemental materials:** Additional materials are posted on RPI-LMS or my dedicated dropbox folder related to specific lecture topics.

**Catalog Description:** This course serves as an introduction to biomedical imaging, instrumentation and application with focus on data acquisition and image reconstruction. Basic principles of major biomedical imaging modalities and appropriate use of instruments will be covered for solving biomedical problems, such as x-ray radiography, computed tomography, nuclear imaging, magnetic resonance imaging, ultrasounds, and optical imaging.

**Prerequisites:** PHYS 1200 (Physics II) **Co-requisites:** None

**Course Classification:** Required for all BME students

**Course Outcomes:**

Students who successfully complete the course should be able to:

* Perform basic Fourier analysis and signal processing tasks using MatLab
* Draw and explain the critical components of biomedical imaging instruments
* Understand how the systems work, and describe the characteristics of the resultant images
* List advantages and limitations of each imaging modality

**Student Outcomes:**

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| (X) | 1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
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| (X) | 1. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
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| ( ) | 1. an ability to communicate effectively with a range of audiences
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| ( ) | 1. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
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| ( ) | 1. an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
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| ( ) | 1. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
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| ( ) | 1. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies
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**BME Program Criteria:**

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| ( ) | 9.a The program must prepare graduates to understand biology and physiology, and the capability to apply advanced mathematics (including differential equations and statistics), science, and engineering to solve the problems at the interface of engineering and biology. |
| (X) | 9.b The curriculum must prepare graduates with the ability to make measurements on and interpret data from living systems, addressing the problems associated with the interaction between living and non-living materials and systems. |

**Topics:** Linear system, Fourier analysis, signal processing, circuit and network analysis; image quality assessment; principles, instrumentation and application of x-ray radiography, computed tomography, nuclear imaging, magnetic resonance imaging, ultrasound and optical imaging.