

ECE 607: FUNDAMENTALS OF ULTRASONICS

Spring 2020

Objectives

This course gives an in-depth coverage of technical concepts that are fundamental to the use of ultrasound in biomedicine. Concepts to be addressed include: acoustic wave propagation theory, field profile in ultrasound imaging, principles of ultrasound-based flow estimation, and the biophysical foundations of therapeutic ultrasound. The overall aim of this course is to equip students with essential foundational knowledge in biomedical ultrasonics, starting from first principles in wave physics.

Course Learning Outcomes

By the end of this course students should be able to demonstrate a threshold level of mastery of the following learning outcomes:

1. Derive the fundamental laws that govern biomedical ultrasonics and acoustic wave propagation
2. Perform calculations related to ultrasound beamforming, flow detection, and estimation
3. Explain the laws that govern the development of therapeutic ultrasound applications

Course Prerequisites: ECE 207 (Signals and Systems), ECE 375 (Electromagnetic Fields and Waves), and BME 487-T1 (Ultrasound in Medicine and Biology), or equivalent courses.

*** Students who wish to gain introductory knowledge in biomedical ultrasonics should take BME 487-T1 in the Fall term instead of ECE 607. ***

Other Essential Skills Required: Mature proficiency in Matlab programming and vector calculus (especially important for the Spring 2020 offering of ECE 607 since it will be a fully online course).

Instructor

Alfred C. H. Yu
Professor, Electrical and Computer Engineering
E-mail: alfred.yu@uwaterloo.ca
Ext: 36908
Office: XXXXXXXXXX

Grading Scheme

Assignments 70%
Term Project 30%

Learning Resources

Required text: RSC Cobbold. *Foundations of Biomedical Ultrasound*. Oxford University Press, 2007.

Reference Articles: To be provided by the instructor on LEARN.