ME 700: Special Topics in Mechanical Engineering
Biomedical Ultrasound
Lecture: MW 12:00 – 1:50 PM PSY B045

Instructor: Dr. Tyrone M. Porter
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Office Hours: by appointment
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Required Textbooks:
Cobbold RSC, *Foundations of Biomedical Ultrasound*, Oxford University Press, Inc., 2007.

Supplemental Textbooks/Resources:
Hill CR, Bamber JC, ter Haar GR, *Physical Principles of Medical Ultrasonics, 2nd ed*, John Wiley and Sons, Ltd., 2004

Course Topics:
- Diagnostic ultrasound (wave propagation, theoretical predictions of acoustic fields, scattering theory, ultrasound contrast agents, transducer design)
- Therapeutic ultrasound (tissue ablation, blood clot dissolution, drug and gene delivery)

Grading:
Final grades will be based upon performance on assignments and a final term paper/presentation

Date	Required Reading	Topic
1/13	-	Introduction
1/20	Chapter 1, Section 3-5	Wave Equation, Acoustic Impedance, Acoustic Intensity
1/25, 27	Chapter 1, Section 6-7 Chapter 2, Section 1-2	Reflection, Transmission and Refraction Diffraction Equations, Rayleigh Integral
2/1, 3	Chapter 2, Section 3 Chapter 3, Section 1, 4	Angular Spectrum Method Approximate Methods
2/8, 10	Chapter 1, Section 8 Chapter 3, Section 10	Attenuation, Absorption, Scattering, & Dispersion Effects of Attenuation on Acoustic Fields
2/16	-	Visiting Lecture – Greg Clement Arrays for Intracranial Applications of Acoustics
2/17	Chapter 6, Section 5-7	Modeling Transducer Performance
2/22, 24	Chapter 4	Visiting Lecture – Robin Cleveland Nonlinear Acoustics

3/1, 3	Chapter 5, Section 1 – 3 Chapter 5, Section 4, 6-7	Scattering Theory
3/8 - 12	Spring Recess	
3/15, 17	Handouts	Physics of Ultrasound Contrast Agents
3/22	Handouts	Contrast-Enhanced Imaging
3/24	-	Visiting Lecture – Paul Barbone Elastography
3/29, 31	Handouts	Tumor Ablation, Bubble-enhanced Heating Thermal Index
4/5, 7	Handouts	Cavitation, Mechanical Index, Sonoporation Sonothrombolysis
4/12, 14	Handouts	Opening Blood-Brain Barrier Particles for Drug and Gene Delivery
4/19, 21	No Class	
4/26, 28	-	Student Presentations

Practice Problems:
Chapter 3: 14, 16, 18, 20, 22
Chapter 3: 33, 34, 38, 47, 55
Chapter 6: 13, 15, 16
Chapter 4: 1, 14, 55, 57, 67
Chapter 5: 17, 20, 24, 27, 31
Chapter 5: 60, 62; Chapter 6: 52, 54, 61