ROCHESTER INSTITUTE OF TECHNOLOGY
COURSE OUTLINE FORM

COLLEGE OF SCIENCE

Chester F. Carlson Center for Imaging Science

NEW COURSE: COS-IMGS-731 – Ultrasound Imaging

1.0 Course Approvals

Required course approvals:	**Approval request date:**	**Approval granted date:**
Academic Unit Curriculum Committee	9/10/2010	9/25/2010
College Curriculum Committee	9/28/2011	10/12/11

Optional designations:	**Is designation desired?**		***Approval request date:**	****Approval granted date:**
General Education:		No		
Writing Intensive:		No		
Honors		No		

2.0 Course information:

Course title:	Ultrasound Imaging
Credit hours:	3
Prerequisite(s):	COS-IMGS-616 and COS-IMGS-682, or permission of instructor
Co-requisite(s):	None
Course proposed by:	María Helguera
Effective date:	Fall 2013

	Contact hours	**Maximum students/section**
Classroom	3	25
Lab		
Studio		
Other (specify)		

2.1 Course Conversion Designation (Please check which applies to this course)

	Semester Equivalent (SE) Please indicate which quarter course it is equivalent to:
	Semester Replacement (SR) Please indicate the quarter course(s) this course is replacing:
x	New

2.2 Semester(s) offered (check)

Fall X	Spring	Summer	Other

All courses must be offered at least once every 2 years. If course will be offered on a bi-annual basis, please indicate here: X

2.3 Student Requirements

Students required to take this course: (by program and year, as appropriate)
None

Students who might elect to take the course:
Imaging science graduate students pursuing the specialization track in medical imaging, and other Imaging Science graduate students. Engineering students interested in medical imaging systems

3.0 Goals of the course (including rationale for the course, when appropriate):

Present the physical principles, applications, and mathematics of ultrasound imaging and tissue characterization

4.0 Course description

IMGS-731 Ultrasound Imaging

This course is an overview of the physics and signal processing principles of ultrasound as applied to the different medical imaging modalities such as B-mode, M-mode, Doppler, and 3D imaging. Tissue characterization methods are introduced. (COS-IMGS-616 and COS-IMGS-682, or permission of instructor) **Class 3, Credit 3 (F, alternate years)**

5.0 Possible resources (texts, references, computer packages, etc.)

Szabo, *Diagnostic Ultrasound Imaging: Inside Out*. Elsevier, Waltham, MA

6.0 Topics (outline):

6.1 Introduction
- 6.1.1 Ultrasound and other diagnostic imaging modalities
- 6.1.2 Fourier analysis

6.2 Acoustic Wave Propagation
- 6.2.1 Plane waves in liquids and solids
- 6.2.2 Elastic waves in solids

6.3 Attenuation
- 6.3.1 Losses in tissues
- 6.3.2 Frequency and time domain losses
- 6.3.3 Tissue models

6.4 Transducers
- 6.4.1 Beamforming. Diffraction
- 6.4.2 Array Beamforming

6.5 Scattering
- 6.5.1 Tissue characterization

6.6 Imaging systems

6.6.1 Doppler
6.6.2 Color Doppler
6.7 Nonlinear Acoustics
6.7.1 Ultrasound Induced Bioeffects
6.8 Contrast Agents

7.0 Intended course learning outcomes and associated assessment methods of those outcomes

Course Learning Outcome	Homework	Exams
7.1 Identify different imaging modalities	X	X
7.2 Describe wave propagation and attenuation	X	X
7.3 Describe the functioning of ultrasound imaging equipment	X	X
7.4 Describe ultrasound tissue characterization	X	X
7.5 Identify and describe nonlinear acoustics and contrast agents	X	X

8.0 Program outcomes and/or goals supported by this course

8.1 Students gain an understanding of ultrasound imaging, signal processing, and tissue characterization.
8.2 Prepares students with the education necessary to pursue careers in industry or to proceed to graduate research in imaging-related disciplines.

9.0

	General Education Learning Outcome Supported by the Course	Assessment Method
Communication		
	Express themselves effectively in common college-level written forms using standard American English	
	Revise and improve written and visual content	
	Express themselves effectively in presentations, either in spoken standard American English or sign language (American Sign Language or English-based Signing)	
	Comprehend information accessed through reading and discussion	
Intellectual Inquiry		
	Review, assess, and draw conclusions about hypotheses and theories	
	Analyze arguments, in relation to their premises, assumptions, contexts, and conclusions	
	Construct logical and reasonable arguments that include anticipation of counterarguments	
	Use relevant evidence gathered through accepted scholarly methods and properly acknowledge sources of information	
Ethical, Social and Global Awareness		
	Analyze similarities and differences in human experiences and consequent perspectives	
	Examine connections among the world's populations	
	Identify contemporary ethical questions and relevant stakeholder positions	
Scientific, Mathematical and Technological Literacy		
	Explain basic principles and concepts of one of the natural sciences	
	Apply methods of scientific inquiry and problem solving to contemporary issues	
	Comprehend and evaluate mathematical and statistical information	
	Perform college-level mathematical operations on quantitative data	
	Describe the potential and the limitations of technology	
	Use appropriate technology to achieve desired outcomes	
Creativity, Innovation and Artistic Literacy		
	Demonstrate creative/innovative approaches to course-based assignments or projects	
	Interpret and evaluate artistic expression considering the cultural context in which it was created	

10.0 Other relevant information (such as special classroom, studio, or lab needs, special scheduling, media requirements, etc.)

This course needs to be taught in the Biomedical and Materials Multimodal Imaging Lab at the Center for Imaging Science, such as CAR-2101