Lincoln University

DI 210 – Advanced Ultrasound Physics and Technology

COURSE SYLLABUS
Summer 2019

Instructor:	Chris T. Nguyen, Ph. D. (*)
Lecture Schedule:	Tuesday and Thursday, 9:00 AM – 11:45 AM
Credits:	3 units / 45 hours of lectures
Level:	Advanced (A)
Office Hours:	By appointment
	e-mail: cnguyen@lincolnuca.edu, or chinguyen39@gmail.com
	Home Phone: 510-489-8727
	Cell. Phone: 498-439-3448
Textbooks and Resource Materials:	**Diagnostic Ultrasound: Principles and Instruments** by Frederic W. Kremkau, Saunders Publishing, 8th Edition or later one.
	ARDMS Physics Test Samples from different sources
	"Ultrasonography Examination" by Appleton & Lange
	"Ultrasound Physics Review" by Davies Publishing
	Selected Articles from the "Journal of Ultrasound in Medicine"
	Selected Articles from the "Journal of Ultrasound in Medicine and Biology"
	Selected Articles from the "Journal of the American Society of Echocardiography"
Prerequisite:	*Completion of all DI 100 series coursework*
Last Revision:	May, 2019

CATALOG DESCRIPTION

This course provides a quick review of "Physical Principles of Ultrasound" and then introduces advanced technologies, systems, probes, imaging modes, and applications in sonography. *Prerequisite: Completion of all DI 100 series coursework*

EDUCATIONAL OBJECTIVES AND STUDENT LEARNING OUTCOMES

Upon satisfactory completion of this Course, the students will be able to:

1. Operate some widely used Ultrasound systems by GE, Philips, Siemens and others.
2. Understand and apply different imaging modes: Doppler, Tissue velocity, M-Mode, Color M-Mode, Contrast-Enhanced Imaging, Strain & Strain Rate Measurements, Sonoelastography, and Acoustic Radiation Force Impulse.
3. Optimize system controls for optimal 2D-images, Doppler spectrum accuracy, Power Doppler sensitivity, Strain & Strain Rate measurement accuracy.
4. Understand the theory, operation and handling of different types of Probes: 3D, 4D, TEE, Endovaginal, Endorectal; Understand indications and contra-indications related to endo-cavity probe usage.
5. Understand and recognize all artifacts, particularly the recently reported ones. Learn to avoid them or to utilize them to our advantage (2D-Imaging and Doppler).
6. Understand Bio-Effects namely Thermal and Mechanical ones. Select suitable Thermal Index (TI) and Mechanical Index (MI) for particular applications (Imaging of bones, Contrast Imaging. Observe ALARA.
7. Properly maintain the systems, probes, and related equipment / materials for optimal Quality & Reliability and Safety. Understand different types of phantoms, targets.
8. Understand the principles of other commonly used imaging modalities (MRI, Mammography, CT scan, PET Scan…) for correlation with Ultrasound results.
9. Understand simple statistical calculations for the interpretation of Ultrasound results such as Distribution, Mean value, Standard Deviation (SD), Sensitivity, Specificity, Accuracy, Positive Predictive Value (PPV), Negative Predictive Value (NPV)…

STUDENT LEARNING OUTCOME ASSESSMENTS

1. Weekly Quizzes
2. Mid-term and Final Examinations
3. Instructor Observation through Class Open Discussions
4. Instructor Observation through student Lab. Practices
5. Student Results of the ARDMS Certification Physics Test

The two main objectives of this Course are:

- **Review materials on "Ultrasound Principles and Instrumentation" to prepare the students for the ARDMS Board Registration Physics Test.**
- **Show the students how to properly, effectively & safely perform US Systems for best results in various Diagnostic Sonography studies.**

The students are strongly encouraged to join – The American Institute of Ultrasound in Medicine (AIUM), and – The American Society of Echocardiography (ASE), as "student members" in order to be exposed to the real world of Ultrasound in Medicine.

COURSE LEARNING OUTCOMES[1]

Course LO	Program LO	Institution LO	Assessment activities
Operate some widely used Ultrasound systems by GE, Philips, Siemens and others. Understand and apply different imaging modes: Doppler, Tissue velocity, M-Mode, Color M-Mode, Contrast-Enhanced Imaging, Strain & Strain Rate Measurements, Sonoelastography, and Acoustic Radiation Force Impulse. Optimize system controls for optimal 2D-images, Doppler spectrum accuracy, Power Doppler sensitivity, Strain & Strain Rate measurement accuracy.	PLO 1, PLO 2	ILO 1a, ILO 2a, ILO 3a	In-class activities, quizzes, midterm and final exams.
Understand the theory, operation and handling of different types of Probes: 3D, 4D, TEE, Endovaginal, Endorectal; Understand indications and contra-indications related to endo-cavity probe usage. Understand and recognize all artifacts, particularly the recently reported ones. Learn to avoid them or to utilize them to our advantage (2D-Imaging and Doppler).	PLO 2	ILO 1a,	In-class activities.
Understand Bio-Effects namely Thermal and Mechanical ones. Select suitable Thermal Index (TI) and Mechanical Index (MI) for particular applications (Imaging of bones, Contrast Imaging. Observe ALARA.	PLO 3	ILO 1a, ILO 4a	In-class activities, quizzes, midterm and final exams

INSTRUCTIONAL METHODS

Instructional methods will include lectures by the instructor and lab sessions under his guidance. Classroom activities are collaborative – students should help one another in class as well as in lab. The instructor will be available to assist students with all tutorials and other assignments.

The Course consists of **15 lectures, weekly quizzes, Q and A Sessions, Class Open Discussions, Midterm and Final Examinations**, **several lab sessions** (30 min. each). **Attendance will be recorded at every class meeting.**

Assignments and projects require students to actively use resources of the library.

[1] Detailed description of learning outcomes and information about the assessment procedure are available at the Center for Teaching and Learning website (ctl.lincolnuca.edu).

Detailed guide to business *resources of the library* as well as the description of Lincoln University approach to *information literacy* are available at the Center for Teaching and Learning website (ctl.lincolnuca.edu).

EVALUATION AND GRADING

Evaluation is based on attendance, lab participation, quizzes, midterm and final exams. To successfully complete this course, the student should attend more than 80% of the lectures, and have a total score of 70% or higher.

95-100	A
90-94	A-
87-89	B+
84-86	B
81-83	B-
78-80	C+
76-77	C
74-75	C-
72-73	D+
70-71	D
69≤	F

Class attendance	10%
Quizzes	25%
Midterm Exam	25%
Final exam	40%
Total	100%

COURSE SCHEDULE

Lectures		Topic	Quizzes	
#	Date		#	On Lecture
1	11-June	(a) Reviews all materials in DI 210 Course		
2	13-June	(a) Reviews all materials in DI 210 Course (b) Covers Item 1 of the Course Objectives.	1	1
3	18-June	Covers Item 2 of the Course Objectives.	2	2
4	20-June	Covers Item 3 of the Course Objectives.	3	3
5	25-June	Covers Item 4 of the Course Objectives.	4	4
6	27-June	Midterm Exam (Items 1, 2, 3 & 4) Lecture Item 5 of the Course Objectives.		
7	2-July	Covers Item 6 of the Course Objectives.	5	5, 6
	4-July	Independence Day – No classes		
8	9-July	Covers Item 7 of the Course Objectives.	6	7
9	11-July	Covers Item 8 of the Course Objectives.	7	8
10	16-July	Covers Item 9 of the Course Objectives.	8	9
11	18-July	Reviews all Items 1 to 9 of the Course Objectives. ARDMS Physics Test Questions.	9	10
12	23-July	Reviews all Items 1 to 9 of the Course Objectives. Provides answers to 900+ ARDMS Physics Test Questions		
13	25-July	Final Exam		

(*) INSTRUCTOR AFFILIATIONS

- A Reviewer for the Journal "Ultrasound in Medicine" since 2010
- A Reviewer for the Journal "Ultrasound in Medicine and Biology" since 2006 (have reviewed more than 80 Manuscripts).
- An Advisory Editorial Board Member of the Journal "Ultrasound in Medicine and Biology" since 2012

TEACHING / LEARNING FEEDBACK**:** Result of the actual **ARDMS Physics Test** (120 Questions / 2 hours) by the Students is gauged as teaching / learning feedback.