

Advanced Ultrasound Physics (DMSO 2243)



Credit: 2 semester credit hours (2 hours lecture)

Prerequisite/Co-requisite: Passed all previous sonography courses.

Course Description

Theory and application of ultrasound principles. Includes advances in ultrasound technology.

Required Textbook and Materials

1. Understanding Ultrasound Physics by Sidney K. Edelman, Ph. D
ISBN# 0-9626444-4-7

Course Objectives

Upon completion of this course, the student will be able to:

1. Describe and discuss ultrasound principles and instrumentation, including modes of operation..
2. Techniques for recording sonographic images, and advances in ultrasound technology.
3. Describe and discuss potential bioeffects of ultrasound.
4. Techniques in quality assurance of ultrasound.

Course Outline

- A. Quality assurance
 - a. Requirements
 - i. Assessment of system components
 - ii. Repairs
 - iii. Preventive maintenance
 - iv. Record keeping
 - b. Goals
 - i. Proper operation of equipment
 - ii. Detect gradual changes
 - iii. Minimize downtime
 - iv. Reduce non-diagnostic exams
 - v. Reduce repeat scans
 - c. Devices
 - i. AIUM 100mm test object
 - ii. Tissue equivalent phantom
 - iii. Doppler phantom
 - iv. Beam profile/slice thickness phantom
- B. Bioeffects
 - a. Devices

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- i. Hydrophone
 - ii. Radiation Force balance
 - iii. Acousto-optics
 - iv. Calorimeter
 - v. Thermocouple
 - vi. Liquid crystals
 - b. Risk-Benefit relationship
 - c. Dosimetry
 - d. In vitro vs. In vivo
 - e. AIUM Statement on In Vitro Bioeffects
- C. Research Study techniques
 - a. Mechanistic approach
 - b. Empirical approach
- D. Epidemiological studies
 - a. Prospective
 - b. Retrospective
- E. Mechanisms of bioeffects
 - a. Thermal Mechanism
 - i. Thermal index
 - ii. Empirical findings
 - b. Cavitation Mechanism
 - i. Mechanical index
 - ii. Empirical findings
 - 1. Stable cavitation
 - 2. Transient cavitation
 - c. Clinical safety and prudent use of ultrasound
 - i. AIUM – prudent use
 - ii. AIUM – clinical safety
 - iii. AIUM – safety in training and Research
 - d. Electrical safety
 - e. Overall safety considerations
- F. New advances in sonography
 - a. Harmonic imaging
 - b. 3D and 4D imaging
- G. New advances in digital storage
 - a. PACS system
 - b. Telemedicine
 - c. Magneto-optical storage
- H. Use of contrast in sonography
 - a. Definity
 - b. Saline

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Grade Scale

93 – 100	A
85 – 92	B
75 – 84	C
68 - 74	D (not able to continue in sonography program)

Course Evaluation

Semester grades will be calculated from the following criteria:

1. Unit tests 100%

Course Requirements

1. Unit tests
2. Class participation
3. Daily work assignments (worksheets, reading assignments, presentations)

Course Policies

1. No food, drinks, or use of tobacco products in class.
2. Beepers, cell phones, head phones and any other electronic devices must be turned off while in class.
3. Do not bring children to class.
4. If a unit test is missed, arrangements will be made with the instructor to take the test in a timely manner.
5. Attendance Policy: Absences must be limited to serious illness and/or immediate family emergencies. Unexcused absences are not allowed. **Three (3) absences will result in a letter grade reduction. Excessive tardiness (more than 10 minutes/class or more than 2 consecutive classes)** will result in an absence being awarded. In the event that LIT is forced to cancel classes due to inclement weather, DMS classes and clinical rotation will also be canceled. Notification of closures will be made through local radio and TV stations. Students out of the immediate broadcast area should contact the Program Director for information. It is extremely important that students communicate with the faculty regarding absences by telephone and/or email at all times.
6. All assignments are due when stated. Late assignments will result in a drop of **10** points per late day, and more than five days past due will result in a grade of **0**. If a student has an excused absence with written documentation, assignments will be accepted at the beginning of class upon return. Missed in-class assignments receive a grade of **0**.
7. Cheating on any (lecture/lab) exam results in immediate dismissal from the program and an **F** for the course.
8. If you wish to drop a course, the student is responsible for initiating and completing the drop process. If you stop coming to class and fail to drop the course, you will earn an “**F**” in the course.

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Disabilities Statement

The Americans with Disabilities Act of 1992 and Section 504 of the Rehabilitation Act of 1973 are federal anti-discrimination statutes that provide comprehensive civil rights for persons with disabilities. Among other things, these statutes require that all students with documented disabilities be guaranteed a learning environment that provides for reasonable accommodations for their disabilities. If you believe you have a disability requiring an accommodation, please contact the Special Populations Coordinator at (409) 880-1737 or visit the office in Student Services, Cecil Beeson Building.

Course Schedule

Week of	Topic	Reference
Week 1	Quality assurance (requirements and goals)	Edelman: pgs. 353-354
Week 2	Devices to perform QA	Edelman: pgs. 354-349
Week 3	Performance Measurements	Edelman: pgs. 360-364
Week 4	Test I	
Week 5	Bioeffects - dosimetry	Edelman: pgs. 369
Week 6	Device to measure bioeffects	Edelman: pgs. 365-368
Week 7	In Vivo vs. In Vitro lab results	Edelman: pgs. 369-370
Week 8	Study techniques	Edelman: pgs. 371
Week 9	Mechanisms of bioeffects	Edelman: pgs. 372-376
Week 10	Epidemiology studies	Edelman: pgs. 377-386
Week 11	AIUM results	Edelman: pgs. 378-380
Week 12	Test II	
Week 13	New advances in sonography	Student presentations
Week 14	New advances in digital storage	Student presentations
Week 15	Contrast use in sonography	
Week 16	Review for Sonography boards and final	

Contact Information:

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