

Doppler Physics (DMSO 2351)



Credit: 3 semester credit hours (3 hours lecture)

Prerequisite/Co-requisite: Admission into the sonography program.

Course Description

Doppler and hemodynamic principles relating to arterial and venous imaging and testing.

Required Textbook and Materials

1. Understanding Ultrasound Physics by Sidney K. Edelman, Ph.D
ISBN#0-926444-4-7
www.esp-inc.com

Course Objectives

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

1. Describe Doppler and hemodynamic principles and actions.
2. Interpret methods of Doppler flow analysis.
3. Differentiate common image artifacts.
4. Describe potential bioeffects.

Course Outline

- A. LIT
 - a. Policies
 - b. Academic calendar
 - c. Classroom policies
- B. Harmonics and Contrast Agents
 - a. Fundamentals of Harmonic Imaging
 - i. Tissue harmonics
 - ii. Pulse inversion harmonics
 - b. Contrast Agents
 - i. Contrast harmonics
- C. Hemodynamics
 - a. Hemodynamics
 - i. Flow
 - ii. Stenosis
 - b. Energy
 - i. Gradients
 - ii. Forms of energy
 - iii. Energy losses in the circulation
 - c. Pressure-Flow relationships
 - i. Stenosis
 - ii. Bernoulli's principle
 - iii. Ohm's Law

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- d. Venous Hemodynamics
 - i. Hydrostatic pressure
 - ii. Breathing and venous flow
- D. Doppler
 - a. The Doppler equation
 - b. Types of Doppler
 - i. Bidirectional
 - 1. Continuous wave
 - 2. Pulsed wave
 - c. Aliasing
 - i. Nyquist limit
 - d. Color Flow Doppler
 - i. Color maps
 - e. Doppler artifacts
 - f. Spectral Analysis
 - i. Spectral
 - ii. Color flow
- E. Optimizing Doppler Imaging
 - a. Normal Incidence
 - b. Color Doppler gain
 - c. Spectral Doppler gain
 - d. Aliasing
 - e. Wall filters
- F. Quality Assurance
 - a. Requirements
 - b. Objective vs. Subjective
 - c. Phantoms
 - i. AIUM test object
 - ii. Tissue equivalent phantom
 - iii. Doppler phantom
 - iv. Slice thickness phantom
 - d. Performance measurements
 - i. Dead zone
 - ii. Registration
 - iii. Resolution
 - iv. Focal zone
 - v. Gray scale
- G. Bioeffects
 - a. Converting sound energy into heat
 - b. Risk-benefit relationship
 - c. Mechanisms of bioeffects
 - i. Thermal
 - ii. Cavitation
 - d. Study techniques
 - i. Mechanist approach
 - ii. Empirical approach

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- iii. Epidemiological studies
- e. Clinical safety and prudent use
 - i. Electrical safety
- H. Sonographers in the Clinical Setting
 - a. Major principles of medical ethics
 - b. Informed consent
 - c. Patient – sonographer interaction
 - d. Sonographer – work environment interaction
 - e. Standard precautions

Grade Scale

- 93 – 100 A
- 85 – 92 B
- 77 – 84 C
- 69 - 76 D (not able to continue in sonography program)
- 68 and below F

Course Evaluation

Semester grades will be calculated from the following criteria:

- 1. Unit tests/Final 100%

Course Requirements

- 1. Unit tests

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. All exams will be on the dates specified unless the instructor makes a change. In case of an absence on exam day, the exam must be completed on the day the student returns to class or a grade of zero will be awarded.
- 6. Attendance Policy: Students are expected to be in class unless prior arrangements have been made. Absences must be limited to serious illness and/or immediate family emergencies. Unexcused absences are not allowed. **Three (3) lecture absences will result in a letter grade reduction. Two (2) lab absences will result in a 10 point grade reduction from the overall lab average. 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.**

7. 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**.
8. Whenever testing occurs, all books/ backpacks must be placed in the front of the classroom away from the entire class. Cellphones are to be placed in a basket in the front of the room and will be returned when the test is turned in. If a student is caught with an electronic device that was not given to the instructor he/she will be given zero for the exam and can be construed as cheating.
9. Whenever testing occurs, all books/ backpacks must be placed in the front of the classroom away from the entire class. Cellphones are to be placed in a basket in the front of the room and will be returned when the test is turned in. If a student is caught with an electronic device that was not given to the instructor he/she will be given zero for the exam and can be construed as cheating.
10. It shall be considered a breach of academic integrity (cheating) to use or possess on your body any of the following devices during any examination unless it is required for that examination and approved by the instructor: Cell phone, smart watch/watch phone, laptop, tablet, electronic communication devices (including optical), and earphones connected to or used as electronic communication devices.
 - a. **Cheating on any (lecture) exam results in immediate dismissal from the program and an F for the course.**
11. You will have the length of the class to finish an exam. No extra time will be given.
12. 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.
13. No extra credit assignments will be given in this course.
14. Students with special needs and/or medical emergencies or situations should communicate with their instructor regarding individual exceptions/provisions. It is the student’s responsibility to communicate such needs to the instructor.

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15. Additional class policies as defined by the individual course instructor and sonography handbook.

Technical Requirements (for courses using Blackboard)

The latest technical requirements, including hardware, compatible browsers, operating systems, software, Java, etc. can be found online at:

https://help.blackboard.com/en-us/Learn/9.1_2014_04/Student/015_Browser_Support/015_Browser_Support_Policy

A functional broadband internet connection, such as DSL, cable, or Wi-Fi is necessary to maximize the use of the online technology and resources.

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. You may also visit the online resource at <http://www.lit.edu/depts/studerv/special/defaults.aspx>

Student Code of Conduct Statement

It is the responsibility of all registered Lamar Institute of Technology students to access, read, understand and abide by all published policies, regulations, and procedures listed in the *LIT Catalog and Student Handbook*. The *LIT Catalog and Student Handbook* may be accessed at www.lit.edu or obtained in print upon request at the Student Services Office.

Starfish

LIT utilizes an early alert system called Starfish. Throughout the semester, you may receive emails from Starfish regarding your course grades, attendance, or academic performance. Faculty members record student attendance, raise flags and kudos to express concern or give praise, and you can make an appointment with faculty and staff all through the Starfish home page. You can also login to Blackboard or MyLIT and click on the Starfish link to view academic alerts and detailed information. It is the responsibility of the student to pay attention to these emails and information in Starfish and consider taking the recommended actions. Starfish is used to help you be a successful student at LIT.

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Course Schedule

Please note that the online version of the *LIT Catalog and Student Handbook* supersedes all other versions of the same document

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Week	Topic	Reference
Week 1	Hemodynamics	Edelman's Chapter 18 Power point
Week 2	Hemodynamics	Edelman's Chapter 18 Power point
Week 3	Test 1	Edelman's Chapter 18 Power point
Week 4	Doppler	Edelman's Chapter 19 Power point
Week 5	Doppler	Edelman's Chapter 19 Power point
Week 6	Test 2	Edelman's Chapter 19 Power point
Week 7	Optimizing Doppler Imaging	Edelman's Chapter 20 Power point
Week 8	Optimizing Doppler Imaging	Edelman's Chapter 20 Power point
Week 9	Test 3	Edelman's Chapter 20 Power point
SPRING BREAK		
Week 10	Artifacts	Edelman's Chapter 21
Week 11	Test 4 Quality Assurance	Edelman's Chapter 22 Power point
Week 12	Quality Assurance Test 5	Edelman's Chapter 22 Power point
Week 13	Bioeffects	Edelman's Chapter 23 Power point
Week 14	Bioeffects	Edelman's Chapter 23 Power point
Week 15	Test 7	Edelman's Chapter 24 Power point
Week 16	Sonographers in the Clinical Setting	Edelman's Chapter 23 Power point

Contact Information

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