

Doppler Physics (DMSO 2351 3A1)

CREDIT

3 Semester Credit Hours (3 hours lecture, 0 hours lab)

MODE OF INSTRUCTION

Face to Face

PREREQUISITE/CO-REQUISITE:

Passed all previous sonography courses.

COURSE DESCRIPTION

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

COURSE OBJECTIVES

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

- Describe Doppler and hemodynamic principles and actions.
- Interpret methods of Doppler flow analysis.
- Differentiate common image artifacts.
- Describe potential bioeffects.

INSTRUCTOR CONTACT INFORMATION

Instructor: Deena Boland, BS, RDMS, RVT, RT(R), ACUE

Email: dmboland@lit.edu

Office Phone: 409-257-0058

Office Location: GTWY 112

Office Hours: Appointments in Starfish

REQUIRED TEXTBOOK AND MATERIALS

- **Understanding Ultrasound Physics by Sidney K. Edelman, Ph.D. 4th edition. ISBN#0-9626444-5-5.**
- Computer with internet access
- Webcam for taking exams.



**LAMAR INSTITUTE
OF TECHNOLOGY**

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. **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 15 minutes/class or more than 2 consecutive classes)** will result in an absence being awarded. Also, leaving class early 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.**

DROP POLICY

If you wish to drop a course, you are 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.

COURSE CALENDAR

DATE	TOPIC	READINGS (Due on this Date)	ASSIGNMENTS (Due on this Date)
1	Syllabus/Hemodynamics	Syllabus Ch. 18 Hemodynamics and corresponding Powerpoint	
2	Hemodynamics/ Ch. 18 Review	Ch. 18 Hemodynamics and corresponding Powerpoint	Ch. 18 Review Worksheet—Friday 1-27 by 6:00pm
3	Unit Exam 1/ Ch. 19 Doppler	Ch. 19 Doppler and corresponding Powerpoint	Unit Exam 1 Due January 31 by 6:00pm Via Blackboard
4	Ch. 19 Doppler	Ch. 19 Doppler and corresponding Powerpoint	
5	Ch. 19 Doppler	Ch. 19 Doppler and corresponding Powerpoint	
6	Unit Exam 2 Review/ Unit Exam 2	Ch. 19 Doppler and corresponding Powerpoint	Unit Exam 2 Due by February 26 by 6:00pm Via Blackboard

7	Ch. 20 Optimizing Doppler Imaging/ Ch. 22 Quality Assurance	Ch. 20 Optimizing Doppler Imaging, Ch.22 Quality Assurance, and corresponding PowerPoints	
8	Ch. 22 Quality Assurance	Ch. 22 Quality Assurance and corresponding PowerPoint	
9	SPRING BREAK		
10	Unit Exam 3 Review/ Unit Exam 3	Ch. 20 Optimizing Doppler Imaging, Ch.22 Quality Assurance, and corresponding PowerPoints	Unit Exam 3 Due by March 26 by 6:00pm Via Blackboard
11	Ch. 23 Sonographers in the Clinical Setting/ Ch. 24 Bioeffects	Ch. 23 Sonographers in the Clinical Setting, Ch. 24 Bioeffects, and corresponding PowerPoints	
12	Ch. 23 Sonographers in the Clinical Setting/ Ch. 24 Bioeffects	Ch. 23 Sonographers in the Clinical Setting, Ch. 24 Bioeffects, and corresponding PowerPoints	
13	Unit Exam 4/ Registry Review	Ch. 23 Sonographers in the Clinical Setting, Ch. 24 Bioeffects, and corresponding PowerPoints	Unit Exam 4 Due by April 13 by 6:00pm Via Blackboard
14	Registry Review	All Chapters and corresponding PowerPoints	
15	Registry Review	All Chapters and corresponding PowerPoints	
16	Registry Review/ FINAL EXAM	All Chapters and corresponding PowerPoints	FINAL EXAM Due by May 9th by 6:00pm Via Blackboard

COURSE EVALUATION

Final grades will be calculated according to the following criteria:

- Unit Exams 90%
- Course assignments 5%
- Final Exam 5%

GRADE SCALE

- 93-100 A
- 85-92 B
- 77-84 C
- 69-76 D
- 0-68 F

Course Outline

A. LIT

- a. Policies
- b. Academic calendar
- c. Classroom policies

B. Harmonics and Contrast Agents

- a. Fundamental and harmonic images
- b. Tissue harmonics
- c. Pulse inversion harmonics
- d. Contrast agents
- e. Contrast harmonics

C. Hemodynamics

- a. Hemodynamics
 - i Flow
 - ii Stenosis
- b. Energy
 - i. Gradient
 - ii. Forms of energy
 - iii. Energy losses in the circulation
- c. Pressure-Flow relationships
 - i. Stenosis
 - ii. Bernoulli's principle
 - iii. Ohm's Law
- d. 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
 - 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
 - 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
- I. Imaging artifacts
- J. Registry Review

TECHNICAL REQUIREMENTS

The latest technical requirements, including hardware, compatible browsers, operating systems, etc. can be online at <https://lit.edu/online-learning/online-learning-minimum-computer-requirements>. A functional broadband internet connection, such as DSL, cable, or WiFi is necessary to maximize the use of online technology and resources.

DISABILITIES STATEMENT

The Americans with Disabilities Act of 1990 and Section 504 of the Rehabilitation Act of 1973 are federal anti-discrimination statutes that provide comprehensive civil rights for persons with disabilities. LIT provides reasonable accommodations as defined in the Rehabilitation Act of 1973, Section 504 and the Americans with Disabilities Act of 1990, to students with a diagnosed disability. The Special Populations Office is located in the Eagles' Nest Room 129 and helps foster a supportive and inclusive educational environment by maintaining partnerships with faculty and staff, as well as promoting awareness among all members of the Lamar Institute of Technology community. If you believe you have a disability requiring an accommodation, please contact the Special Populations Coordinator at (409)-951-5708 or email specialpopulations@lit.edu. You may also visit the online resource at [Special Populations - Lamar Institute of Technology \(lit.edu\)](#).

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

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.

ADDITIONAL COURSE POLICIES/INFORMATION

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. **All exams will be on the dates specified unless the instructor makes a change. In case of an absence on exam day, the student will have a 10 point reduction on his/her test score. The score will continue to drop 10 points for every class day missed following the test. Also, if the student attends any sonography classes on test day, he/she must take the test that day or a zero will be given. The student will have to make up the test if missed, the class day that the student returns.**
5. The terminology excused or not excused absence does not apply to this class. All absences are equal. Therefore, no matter the circumstances involved in the student's absence it will be counted towards the total for the semester.
6. All assignments are due when stated **at the beginning of class or online at the dates given on the syllabus.** 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**. Missed in-class assignments receive a grade of **0**.
7. 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/lab) exam results in immediate dismissal from the program and an F for the course.**
8. All exams will be online. You will be using LockDown Browser with Webcam Monitoring. The rules for the tests are:
 - Disable all notifications on your computer. This is how LockDown Browser is used to take a test.
 - Locate the "LockDown Browser" shortcut on the desktop and double-click it. (For Mac users, launch "LockDown Browser" from the Applications folder.)

- If prompted to close a blocked program (e.g. screen capture, instant messaging) choose Yes.
- Log into the course, navigate to the test and select it.
- A Startup Sequence will guide the student through a webcam check and other items required by the instructor.
- The test will then start.

20-point deductions for each occurrence:

- Where you are taking your exam must be well lit. If it is not well lit, you will have 20 points deducted from your test.
- Your face must be visible the entire length of the test. If your face cannot be seen even for a few seconds you will have 20 points deducted from your test.
- No music should be playing nor should a TV/radio/video be on in the background.
- You may not read the questions out loud. If you do so, you automatically receive a 20-point deduction.
- You may not wear sunglasses, hats, hoodies, earbuds, headphones, etc. during the exam. Your ears must be fully visible the entire exam, failure to comply with this will be a 20-point deduction. If you do this on another exam it will turn into a 50-point deduction

50-point reduction or a zero on the entire test:

- You must be in a private location. If another person is seen or heard while you are taking your test this could be misconstrued as cheating resulting in a 50-point reduction or a zero. That is up to the situation and your instructor.
- All phones, notes, books, and other papers must be removed from the testing location. If these items are seen during your exam, you receive an automatic zero on the exam.
- Do NOT leave the exam room for any reason, if you do, it is an automatic 50-point deduction.
- Any suspicious activity that appears to be cheating will result in a zero.

Testing Tips

1. You must use Google Chrome browser.
 - You must have a webcam and a microphone attached to your computer
 - Be prepared to scan the room with a camera, if you cannot move your computer, you will need to have a mirror available to assist with scanning the room.
2. It is the student's responsibility to ensure that ALL of the above requirements are met. By completing the verify signature portion of the

exam, you are accepting responsibility for your actions during the exam. Failure to follow the requirements will result in deductions from your exam grade when reviewed by your Instructor.

9. You will have the length of the class to finish an exam. No extra time will be given.
10. Class roll is taken by the sign in sheets. If you did not sign in, you will be counted absent.
11. The sign in sheet will be taken up 15 minutes after class starts. If you are more than 15 minutes late to class, you will be counted absent. Also, if you leave the classroom for more than 15 minutes you will be counted absent.
12. When absent, the student is required to contact the instructor to obtain make-up assignment for missed class. It is the student's responsibility to make up lecture/lab assignments or a grade of zero will be given.
13. 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.
14. There will be no extra credit assignments given in this course.
15. 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.
16. Any student not passing a major test will be required to contact me to schedule a Blackboard Collaborate or face to face session to review the material covered on the exam. It is the student's duty to be prepared for this meeting by reviewing the exam material prior to this meeting.
17. Any taping of the material, when we go over tests/ results, will be considered cheating and you will be dismissed from the program. It is our duty to prepare you for the registry.
18. Additional class policies as defined by the individual course instructor and sonography handbook.
19. Each student is required to participate in a mid-semester program/student evaluation, which at minimum will include the following discussions: student's grades and attendance, current

courses being attempted, current clinical experience, and any problems or concerns the student may be experiencing.