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| **Course Credit:** | 1 Credit |
| **Time and Location:** | Thursday: Class 8:00-9:00am  NURS Rm 210 |
| **Instructor:** | Chelsie Wheatley, BSRS, BSDMS, RT(R), RDMS, RVT |
| **Phone:** | 208-241-1599 or 282-4042 (Secretary, Alyssa) |

**Overview:** This course covers the fundamentals of sonography principles and instrumentation. Basic physics will be covered as well as two-dimensional imaging, real-time imaging, pulsed echo instrumentation, displays and image processing, dynamic range, harmonics and contrast agents, hemodynamics, Doppler, optimizing Doppler imaging, image artifacts, image optimization, quality assurance, sonographers in a clinical setting and bioeffects. Information gained in this course will be used to further sonographic practice and activities are structured to follow guidelines of the ARDMS Sonographic Principles and Instrumentation (SPI) Examination. This course, along with Sonographic Principles and Instrumentation I and III will prepare the student to sit for the SPI Examination.

**Textbooks:** Edelman, Sidney K. *Understanding Ultrasound Physics.* 4th Edition. Woodlands, TX: Sidney K. Edelman; 2012. ISBN 0-9626444-5-5

**Method of Presentation:**  Lecture, PowerPoint, Handouts

**Code of Ethics:** DMS 4408 adheres to the ISU Code of Conduct.  In particular, academic dishonesty, however small, creates a breach in academic integrity.  A student's participation in this course comes with the expectation that his or her work will be completed in full observance of the ISU Code of Student Conduct.

**Course Learning Objectives/Goals:** This course has been designed to prepare student sonographers for the responsibilities of sonographic imaging. The student will learn about transducer arrays, three-dimensional imaging, temporal resolution, image noise, amplification, compensation, compression, demodulation, output power vs receiver gain, dynamic frequency tuning, display controls, Pre and Post processing, dynamic range, harmonics and contrast agents, hemodynamics, Doppler frequency shifts, Continuous and Pulsed wave Doppler, skills necessary to optimize Doppler imaging, and types and causes of imaging artifacts. It will also go over quality assurance and bioeffects.

**Course Learning Outcomes: Upon completion of this course, the student will be able to:**

* Define two-dimensional imaging and explain how an ultrasound system creates it
* Discuss the difference between linear phased, annular phased, linear sequential, and vector array transducers
* Explain slice thickness resolution and its synonyms
* Define Temporal resolution and the differences of it in single vs multi focus transducers as well as narrow vs wide sectors
* List the six major components of ultrasound systems
* Discuss Bi-stable vs Gray scale displays
* Explain Analog and Digital Image data
* List the types of compounding and explain each type
* Define dynamic range and the uses of it
* Explain fundamental vs harmonic frequency and the uses for tissue harmonics
* Know pulse inversion harmonics and its characteristics
* Discuss hemodynamics and the types of blood flow
* List the forms of energy and their role in hemodynamics
* Identify Bernoulli’s Principle and its relationship to the Law of Conservation of Energy
* Explain Pressure-Flow Relationships
* Identify Ohm’s Law and its uses in sonographic physics
* Define hydrostatic pressure and the effects it has on sonographic imaging
* Discuss Doppler imaging with the Doppler Equation and Doppler Shifts
* Define Bidirectional Doppler and its role in vascular sonography
* Compare and Contrast Continuous Wave Doppler and Pulsed Wave Doppler
* Identify Aliasing in a Spectral Doppler Analysis and the reasons it occurs
* Explain ways to optimize Doppler Imaging and the reasons it enhances the accuracy of information
* Define wall filter and its uses
* List the types and causes of sonographic imaging artifacts
* Describe the six main image characteristics terms in sonography
* Know the basic assumptions used in imaging systems
* Compare and contrast reverberation, comet tail, shadow, enhancement, mirror image, speed error, side lobe and grating lobes, refraction, slice thickness, and other artifacts seen in sonography
* Define Quality Assurance and list the requirements, goals, devices and methods for it
* Discuss tissue equivalent, slice thickness, and Doppler phantoms
* Explain the principles of bioethics
* Define informed consent
* Discuss proper patient-sonographer interaction, and sonographer-work environment interaction
* List facility responsibilities on ergonomics and the agency that regulates it
* Define a hydrophone and explain the uses for it
* Discuss biologic effects and safety of ultrasound
* Compare and contrast the mechanistic and empirical approaches
* Compare and contrast thermal mechanism and cavitation mechanism
* List limitations of epidemiologic studies

**Academic Dishonesty Policy:**

Academic dishonesty (cheating, plagiarism, etc.) will not be tolerated in this class and may result in suspension or dismissal from this course and from the program. Cases will also be referred to the Dean of Students for possible dismissal from the university.

Cheating includes, but is not limited to, (1) use of any unauthorized assistance in taking quizzes, tests, or examinations; (2) dependence upon the aid of sources beyond those authorized by the instructor in writing papers, preparing reports, solving problems, or completing other assignments; or (3) the acquisition of tests or other academic materials belonging to the university faculty or staff without permission.

Plagiarism includes, but is not limited to, the use of, by paraphrase or direct quotation without correct recognition, the published or unpublished works of another person. The use of materials generated by agencies engaged in "selling" term papers is also plagiarism.

Many components of DMS 4408 are designed to be highly interactive.  Students are encouraged to take full advantage of the many resources available including Internet sites, handouts and workbooks, other textbooks and journals, faculty, and peers. This interactive collegial learning environment is conducive for life-long learning.

***What does this mean:***  I have allowed ‘printed material’ from the Web site to be available to the student.  This can present problems if not used properly.  Material from quizzes and tests should be used for your OWN study endeavors. Because the quizzes are open book, you should not obtain the answers from other students prior to taking the quizzes.  This defeats the intended learning methodology.  Also, DO NOT obtain material (quizzes and tests) from previous students who have taken this course.  I will consider this cheating and could result in an automatic ‘F’ for the quiz and the course. You may print the quizzes at your discretion, but I DO NOT allow PRINTING of tests.  Additionally tests cannot be reviewed after they have been taken except in my presence. Failure to follow these instructions will result in a failure of the course.

***When students submit their efforts for grading, they are attesting that they have abided by these rules.***

**Classroom Procedure:**

1.  **Attendance:**  You are expected to attend class regularly.  It is your responsibility to maintain a level of attendance which will allow you to derive maximum benefit from the instruction.  Excessive absences (>10%) will result in a lower course grade if you are borderline between two grades.  Conversely, if you have good attendance and are border line between two grades, I will award the higher grade.

2.  **Grading Procedure:**

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| **Assessment Method** | **Percentage Value** |
| Test #1 = Chapters 12-17 | 25% |
| Test #2 = Chapters 18-20 | 25% |
| Test #3 = Chapters 21-24 | 25% |
| Cumulative Final | 25% |
| Total | 100% |

**This grading Scale will be used:**

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| +/- System |  |
| 93-100% A | 73-76% C |
| 90-92% A- | 70-72% C- |
| 87-89% B+ | 67-69% D+ |
| 83-86% B | 63-66% D |
| 80-82% B- | 60-62% D- |
| 77-79% C+ | 59% Below F |

*Note: A grade of C or better is required in this course in order to receive a certificate from the Department of Radiographic Science.*

The minimum requirements to earn a passing grade are successful completion of all tests (70% minimum).  Tests and Quizzes will be a combination of either written or computer based.  Tests will be scheduled to be taken in a computer lab on campus.  The lab in the nursing building on the ground floor is the lab I try to schedule for tests; however, the Turner Lab is close to our classroom, and is the one I will try to schedule if the nursing building lab is not available. It is the student’s responsibility to know when and where tests are scheduled.  Dates are posted in the Web Course Calendar and reminders will be given in class.  Students may use their own wireless laptops if they have one if tests are given in class; otherwise, students are required to use a lab computer when testing.

3. **Computer Account:** All students are required to have an ISU student computer account.  There is no fee required for this account. Obtain the account at the Computer Center, which is located in the basement of the College of Business Building or in the Rendezvous Lab.

4.  **Make-up:** If you are unable to sit for an examination, you may request a make-up exam.  You must inform me that you will not be present for the examination **prior** to the scheduled time.  An additional 10% drop in the test grade will result if prior notification is not given and is not accepted by me prior to taking the test.  The highest grade you can receive for a make-up exam is 89% unless you provide me with an acceptable excuse. An acceptable excuse is defined **as very** sick; a death in the immediate family; some unforeseen circumstance that would prohibit you from taking the exam. The key is to communicate with me directly via email, phone, or in person. Do not speak to another faculty member or the department secretary. I’m very easy to catch with email, but make sure your email is received by me prior to the test deadline.

*In addition, it is a requirement to take all tests offered during the semester.  An incomplete will be issued for the class if a test is not taken.*

***For Your Information:*** *Material from tests you have taken during the semester will be presented again on future tests. This means when you are taking test 2 you may find material from test 1 on the exam, etc.  The material builds on itself and needs to be remembered.*

**Cell phone policy:** Cell phones should not be used in class. They should be place in silent or vibrating mode or turned off. Additionally receiving and retrieving text messages should not occur during class or in labs. Failure to follow this policy will result in a deduction of grade up to 10% at the discretion of the instructor. If you need to communicate to someone outside of the class in an emergency situation please inform the instructor so accommodations to this policy may be made.

**Disability Services:** Students with disabilities who wish to have accommodations provided by the University must self-identify with Disability Services (236-3599) in order to have accommodations provided. Information and applications are available in the Center and may be picked up in person or requested by telephone. The URL is <http://www.isu.edu/ada4isu/>

**Academic Freedom and Responsibility Syllabus Statement:** In carrying out its educational mission, Idaho State University is committed to adhering to the values articulated in Idaho State Board of Education Policy III.B. Membership in the academic community imposes on administrators, faculty members, other institutional employees, and students an obligation to respect the dignity of others, to acknowledge the right of others to express differing opinions, and to foster and defend intellectual honesty, freedom of inquiry and instruction, and free expression on and off the campus of an institution.