# DMS A150: SONOGRAPHIC PHYSICS AND INSTRUMENTATION FOR DMS

| Item | Value |
|---|---|
| Curriculum Committee Approval Date | 10/24/2018 |
| Top Code | 122700 - Diagnostic Medical Sonography |
| Units | 3.5 Total Units |
| Hours | 81 Total Hours (Lecture Hours 54; Lab Hours 27) |
| Total Outside of Class Hours | 0 |
| Course Credit Status | Credit: Degree Applicable (D) |
| Material Fee | Yes |
| Basic Skills | Not Basic Skills (N) |
| Repeatable | No |
| Grading Policy | Standard Letter (S) |

## Course Description

This is the study of physical principles and instrumentation of diagnostic medical sonography. It includes equipment design, instrumentation and application. PREREQUISITE: RADT A100. Transfer Credit: CSU.

## Course Level Student Learning Outcome(s)

1. Create and describe sonographic images that are based upon the principles of physics and instrumentation and apply safety and bio-effects of ultrasound.

## Course Objectives

- 1. Discuss sound waves and pulse creation, from transducer to biologic tissue.
- 2. Describe interaction of sound and media.
- 3. Analyze maintenance of equipment, trouble shooting, and quality control.
- 4. Apply principles of scientific notation, conversion, logarithms and decibels.
- 5. Discuss sonographers and principles of bioethics in the clinical environment.
- 6. Select correct transducers to scan particular organs and regions of the body.
- 7. Identify artifacts which occur while scanning.
- 8. Analyze safety and bioeffects of ultrasound on patients.
- 9. Discuss hemodynamics, laminar and turbulent blood flow patterns and hydrostatic pressure.
- 10. Describe and apply principles of color, pulsed wave and continuous wave Doppler.
- 11. Identify and describe the components of the pulse-echo ultrasound system and their functions.

## Lecture Content

Use a curvilinear array transducer Pulsed echo instrumentation Adjust dynamic range Adjust edge enhancement Adjust overall gain Adjust persistence Adjust depth of focus Adjust display depth based on exam being performed Adjust gray-scale maps Adjust time gain compensation Change the number of focal zones during the exam Use coded excitation Use extended field of view Use frequency compounding Use harmonic imaging Use spatial compounding Modify the exam based on gray-scale artifacts Record digital video clips Record images on a department-wide picture archive and communication (PACS) system Use digital image storage Obtain measurements of anatomic structures Doppler instrumentation and hemodynamics Adjust color angle to flow Adjust color gain Adjust color scale Adjust Doppler scale Adjust color maps Modify the exam based on color artifacts Adjust Doppler angle to flow Adjust Doppler gain Modify the exam based on Doppler artifacts Use power Doppler imaging Evaluate spectral Doppler waveforms Obtain measurements of blood flow velocities Quality assurance Conduct performance tests with Doppler flow phantoms Conduct performance tests using phantoms Protocols Tailor the exam based on situation/ findings New technologies Use contrast agents Perform elastography imaging Use 4-D imaging Use 3-D imaging Use off-line volume rendering for 3-D Sonography Physics and Instrumentation (SPI)Tasks Clinical safety Decrease output power when appropriate Modify the exam based on the displayed mechanical index Modify the exam based on the displayed thermal index Adjust the default presets based on the clinical environment Practice ALARA principles Use ergonomic techniques while scanning Use ergonomic devices to assist with scanning Provide ergonomic education/training Clean and disinfect transducers in accordance to manufacturers guidelines Routinely perform basic cleaning (e.g. cleaning filters) of the ultrasound system Physical principles Select equipment parameters to optimize axial resolution Select equipment parameters to optimize lateral resolution Select equipment parameters to optimize temporal resolution Use knowledge of reflectors to modify scanning technique Ultrasound transducers Choose a specific transducer type based on the area being scanned Manually adjust transducer frequency based on the area being scanned Use endocavity transducers Use linear array transducers Use phased array transducers Use a curvilinear array transducer Pulsed echo instrumentation Adjust dynamic range Adjust edge enhancement Adjust overall gain Adjust persistence Adjust depth of focus Adjust display depth based on exam being performed Adjust gray-scale maps Adjust time gain compensation Change the number of focal zones during the exam Use coded excitation Use extended field of view Use frequency compounding Use harmonic imaging Use spatial compounding Modify the exam based on gray-scale artifacts Record digital video clips Record images on a department-wide picture archive and communication (PACS) system Use digital image storage Obtain measurements of anatomic structu res Doppler instrumentation and hemodynamics Adjust color angle to flow Adjust color gain Sonography Physics and Instrumentation (SPI)Tasks Clinical safety Decrease output power when appropriate Modify the exam based on the displayed mechanical index Modify the exam based on the displayed thermal index Adjust the default presets based on the clinical environment Practice ALARA principles Use ergonomic techniques while scanning Use ergonomic devices to assist with scanning Provide ergonomic education/training Clean and disinfect transducers in accordance to manufacturers guidelines Routinely perform basic cleaning (e.g. cleaning filters) of the ultrasound system Physical principles Select equipment parameters to optimize axial resolution Select equipment parameters to optimize lateral resolution Select equipment parameters to optimize temporal resolution Use knowledge of reflectors to modify scanning technique

Ultrasound transducers Choose a specific transducer type based on the area being scanned Manually adjust transducer frequency based on the area being scanned Use endocavity transducers Use linear array transducers Use phased array transducers Use a curvilinear array transducer Pulsed echo instrumentation Adjust dynamic range Adjust edge enhancement Adjust overall gain Adjust persistence Adjust depth of focus Adjust display depth based on exam being performed Adjust gray-scale maps Adjust time gain compensation Change the number of focal zones during the exam Use coded excitation Use extended field of view Use frequency compounding Use harmonic imaging Use spatial compounding Modify the exam based on gray-scale artifacts Record digital video clips Record images on a department-wide picture archive and communication (PACS) system Use digital image storage Obtain measurements of anatomic structures Doppler instrumentation and hemodynamics Adjust color angle to flow Adjust color gain 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## Lab Content

Application of sonographic physics and instrumentation performed in lab through assignments and hands-on scanning.

## Method(s) of Instruction

- Lecture (02)
- DE Live Online Lecture (02S)
- Lab (04)
- DE Live Online Lab (04S)

## Instructional Techniques

Lecture, PowerPoint presentations, printed handouts and class discussion.

## Reading Assignments

Students are required to read 4.5 hours per week from the assigned text.

## Writing Assignments

Weekly lab assignments have writing components that will be completed outside of the lab session.  This will be 1.5 hours per week.

## Out-of-class Assignments

Group study sessions in the lab are encouraged to enhance learning - 2 -3 hours per week.

## Demonstration of Critical Thinking

Demonstration of critical thinking through class participation and short answers on quizzes and exams.

## Required Writing, Problem Solving, Skills Demonstration

Problem solving and skills demonstration in lab.

## Eligible Disciplines

Diagnostic medical technology-diagnostic medical sonography, neurodiagnosti...: Any bachelors degree and two years of professional experience, or any associate degree and six years of professional experience.

## Textbooks Resources

1. Required Edelman, Sidney. Understanding Ultrasound Physics, Fundamentals and Exam Review, ed. Woodland Hills: Esp, Inc., 2012 Rationale: -