DMS-535: ULTRASOUND PHYSICS AND INSTRUMENTATION II (FORMERLY DMS-135)

Effective Term
Fall 2024

BOT Approval Date
01/11/2024

Discipline
DMS - Diagnostic Medical Sonography

Course Number
535

Course Title
Ultrasound Physics and Instrumentation II (formerly DMS-135)

Short Title
Ultrasnd Phy/Ins II

Credit Status (CB 04)
D - Credit - Degree applicable

Units

Lecture Units
2.00

Total Units
2.00

Hours

Lecture Contact Hours
32-36

Out of Class Hours Lecture
64-72

Total Contact Hours
32 - 36

Total Out of Class Hours
64 - 72

Total Student Learning Hours
96 - 108

Distance Education
Yes

Distance Education

Distance Education Type
Hybrid Only

What will be done in face-to-face meetings

Face to face meetings will be generally utilized for lab demonstrations by the instructor; hands-on student learning and practice of physics concepts and instrumentation; Lab practical evaluations will be done in the campus lab. Group reviews; learned concepts will be enhanced with hands-on application in the campus lab.

Are you using publisher content?

No

Regular Substantive Interaction

Instructor-to-student, student-to-student, and student-to-content contact shall be distributed in a manner that will ensure regular substantive interaction (RSI) is maintained not only weekly but also for the duration of the course. Instructor interactions should be equivalent in time, quality and consistency to the engagement students would receive in a face-to-face course—for example, through announcements, discussion participation, personalized feedback, video messages, or other instructional communications. Instructors are expected to be responsive to student inquiries within a 24-72 hour time frame excluding holidays. RSI will be maintained through a variety of methods: • Orientation - Students must be oriented to the online and face-to-face portions at the start of the course. • Announcements - Announcements using the course management system must be posted at least weekly to keep students current on course events, due dates, materials, etc. • Discussion Forums - Content-related discussion forums within the designated CMS will include appropriate instructor participation and will be initiated and maintained, with timely feedback provided. Instructors are required to monitor the discussions and related activities to provide guidance and direction. Open-ended discussion boards may be used to further learning and interaction. • MSJC Communication – Instructor will use MSJC-administered communication tools (such as email or the designated CMS communication tools) to regularly communicate with and provide ease of access to students. • Timely Feedback - Timely feedback on student work will be provided by the instructor, which may include comments and/or rubrics, within the Grades area of the designated CMS. • Scheduled Meetings – Hybrid and synchronous courses will meet at regularly scheduled times. ADA Compliance - All course interactions and content must be designed with accessibility in mind and meet ADA requirements.

Catalog Description

This course is the second of two physics courses designed to teach Ultrasound Physics and Instrumentation. The focus of this course is image storage and display, hemodynamics, doppler, color flow and color power imaging, artifacts found in ultrasound, quality assurance, and the bioeffects and safety of ultrasound. (formerly DMS-135)

Requisites

Prerequisite(s)

Prerequisite(s) (must be taken before)
DMS-525 (with a grade of C or better).

Codes

TOP Code (CB 03)

1227.00* - *Diagnostic Medical Sonography

CIP Code

51.0910 - Diagnostic Medical Sonography/Sonographer and Ultrasound Technician.

Repeatability Code

No

Grading Option

Letter grade OR P/NP

Learning Objectives

Learning Objectives

Learning Objective
1. Compare and contrast signal processing and image processing.
2. Differentiate and demonstrate image displays and image storage.
3. Analyze and explain hemodynamics.
4. Create a doppler imaging and demonstrate knowledge of the doppler instrumentation used.

5. Distinguish between color flow and color power imaging.
6. Scrutinze artifacts and generalize the effects of artifacts to image quality.
7. Explain and compare guidelines and regulations for quality assurance of ultrasound instrumentation.
8. Assess acoustic output quantities as they relate to bioeffects, safety and quality assurance in ultrasound physics and instrumentation.
9. Recognize the contributions to physics theory and research from women and people from marginalized groups.

Learning Outcome Information

Course Learning Outcomes

Learning Outcome
1. The student will define the image frame rate and what factors help to increase or decrease the frame rate.
2. The student will describe the effects of the edge shadow artifact.
3. The student will calculate the Nyquist limit of a pulsed wave doppler.
4. The student will define energy gradient as it relates to the flow of blood in the human body.
5. The student will describe a famous African-American and Hispanic ultrasound physicist.

Program Learning Outcomes

Learning Outcome
1. Apply knowledge of proper use of ultrasound equipment and demonstrate image improvement through manipulating the instrumentation of the equipment.
2. Complete the American Registry of Diagnostic Medical Sonographers Physics and Instrumentation exam and one or more specialty exams of Abdomen and Obstetrics/Gynecology.

Institutional Learning Outcomes

Aesthetic Awareness: The student will identify and evaluate how aesthetic expression leads to an appreciation of social and cultural context as well as the values of art and nature.
Critical Thinking: The student will analyze problems, gather and synthesize relevant information, evaluate ideas, information, and evaluate alternative points of view to create, innovate and implement effective solutions.
Information and Technology Literacy: The student will access, interpret, evaluate, and apply relevant information sources and digital media effectively, and in an ethical and legal manner.
Scientific Awareness: The student will apply the scientific method of inquiry to assess potential solutions for real-life challenges by employing science-based knowledge and methodologies in daily life.

Content

Course Lecture Content

I. Images, Storage, and Display

A. Role of scan converter
B. Digital Devices
1. Binary system
2. Steps in processing echo information
a. Analog-to-digital converter
b. Digital memory
1. Spatial resolution
2. Contrast resolution
C. Preprocessing versus Postprocessing
1. Functions
D. Display devices
1. TV monitors, LCD monitors, High resolution monitors
a. Brightness
b. Contrast
c. Frame rate

E. Recording and Archiving Techniques
1. Video and Film Format
a. Single or multi-image cameras and laser imagers
1. Photographic film
2. Emulsion film
a. Recorders
1. Fiber-optic
2. Videotape cassette
F. Printers
1. Thermal
2. Laser
3. Digital format
a. Magneto-optical disc (digital still recorder)
b. PACS (Picture Archiving and communication systems)
4. Contrast and brightness control adjustments

II. Hemodynamic, Doppler, Color Flow, and Color Power Imaging

A. Hemodynamics
1. Energy gradient
2. Effects of viscosity, friction, inertia
3. Pressure/flow relationships
4. Velocity
5. Flow
a. Steady, pulsatile, Laminar, turbulent
b. Effects of stenosis on flow characteristics
6. Venous resistance
7. Hydrostatic pressure
8. Pressure/volume relationship
9. Effects of respiration (phasicity)
B. Doppler Physical Principles
1. Doppler Effect
a. Principle as related to sampling red blood cell movement
b. Doppler equation
2. Factors influencing the magnitude of the Doppler shift frequency
a. Range of the Doppler shift frequency
b. Effects of beam angle, transmitted frequency, flow velocity, and flow direction
C. Doppler Instruments
1. Continuous wave and pulsed wave Doppler
a. Differences
b. Advantages and disadvantages of each
1. Aliasing (Nyquist criteria)
2. Range ambiguity
D. Instrumentation
1. Receiver
2. Demodulator
3. Wall filter for clutter rejection
4. Directional devices
E. Duplex instruments-definition and basic principles
F. Spectral analysis
1. Direction

2. Velocity
3. Duration
4. Character
5. Magnitude
G. Fast Fourier transform (FFT)
H. Diagnostic measurements (indices-i.e., pulsatility, resistive)
I. Color Flow Imaging
1. Basic Principles
a. Sampling methods
b. Display of Doppler information
2. Reflector direction
3. Average velocity
4. Velocity variance
c. Advantages and limitations
d. Color field size and frame rate
5. Ensemble length (packet size, pulse packet)
6. Line density
7. Maximum depth e. Color maps, assignment, or coding
J. Color Power (Energy) Mode
1. Displayed information
2. Advantages and limitations III. Artifacts
3. Definition of Artifacts
4. Artifact Recognition in Performing and Interpreting Examinations
5. Artifacts Associated with Resolution and Propagation (Axial Resolution, Lateral Resolution, Section Thickness, Acoustic Speckle)
a. Definitions
b. Mechanisms of Production
c. Appearance
K. Artifacts Associated with Propagation (Reverberation, Comet-tail, Ring-down, Mirror Image, Multipath, Side Lobes, Grating Lobes, Refraction, Speed Error; and Range Ambiguity)
1. Definitions
2. Mechanisms of Production
3. Appearance
L. Artifacts Associated with Attenuation (Shadowing, Enhancement, and Focal Enhancement or Focal Banding)
1. Definitions
2. Mechanisms of Production
3. Appearance
M. Artifacts Associated with Doppler and Color Flow Instrumentation (Aliasing, Slice Thickness, Reverberation, Mirror Imaging, Ghosting or Flash, Registration, Incident Beam Angle, and Clutter
1. Definitions
2. Mechanisms of Production
3. Appearance
N. Other (Electronic Noise, Equipment Malfunction)
1. Definitions
2. Mechanisms of Production
3. Appearance H. Artifact Effects on Measurements (velocity or speed error and range ambiguity)

III. Quality Assurance of Ultrasound Instruments

A. General Concepts Regarding the Need for and Nature of a Quality Assurance Program
B. Methods for Evaluating Instrument Performance
1. Test objects
2. Phantoms (tissue, Doppler, flow)

C. Parameters to Be Evaluated
1. Test object
a. Dead zone
b. Axial resolution and lateral resolution (beam width)
c. Depth calibration accuracy
d. TGC characteristics
e. Uniformity
f. System sensitivity
2. Tissue equivalent (mimicking) phantom
3. Doppler flow, string, or belt phantoms
D. Preventive Maintenance
1. Standard precautions
a. Equipment
1. Cleaning
2. Disinfecting
3. Sterilization
E. Record Keeping
F. Statistical Indices
1. Sensitivity/specificity
2. Negative/positive predictive value
3. Accuracy V. Bioeffects and Safety
G. Acoustic Output Quantities
1. Pressure
a. Units (MPa, mmHg)
b. Peak pressures (compression, rarefaction)
c. Methods of determining pressure (miniature hydrophone)
2. Power
a. Units (mW)
b. Methods of determining power (radiation force, hydrophone)
3. Intensity
a. Units (mW/cm2, W/cm2)
b. Spatial and temporal considerations
c. Average and peak intensities
d. Methods of determining intensity (hydrophones)
e. Common intensities
4. Intensity and power values for different operating modes
H. Acoustic Output Labeling Standard
1. Thermal index
2. Mechanical index
I. Acoustic Exposure
1. Definition and concepts of prudent use (ALARA)
2. Methods of reducing acoustic exposure
J. Primary Mechanisms of Biologic Effect Production
1. Cavitation mechanisms: relevant acoustic parameters
2. Thermal mechanisms: relevant acoustic parameters
K. Experimental Biological Effect Studies
1. Animal studies
2. In vitro studies
3. Epidemiologic studies

a. Limitations
L. Guidelines and Regulations
1. American Institute of Ultrasound in Medicine (AIUM) Statements (e.g., mammalian, epidemiology, in vitro)
2. National Electrical Manufacturers Association (NEMA)
3. Food and Drug Administration (FDA)
M. Electrical and Mechanical Hazards
1. Patient susceptibility to electrical hazard
2. Equipment components which could present a hazard

Methods of Instruction

Method

Group Projects

Integration

Each week, the instructor will facilitate weekly online Kahoot game. The quiz will consist of physics concepts for each weeks' chapter as a review and will be played by the entire class. To create a Kahoot game, the instructor will log onto Kahoot.com, create a user name and password, and follow the steps to add questions and mark the correct answer. In the classroom, the overhead projector will display the Kahoot game. Students will use an android or Iphone, log into Kahoot.com, enter pin number and name. As each question is displayed, students will select their answer using their phone. All answers will be displayed anonymously with the fastest time recorded for each question and final game winner.

DE Adaptations for MOI

Kahoot! can be played online as a synchronous Zoom meeting with classmates or as an individual chapter review. Using an android or Iphone to log into Kahoot.com, enter the game pin number and player name. Answer questions in the fastest time to win the game. Answers will be entered via cloud from each phone at students home. The game can be observed or recorded via Zoom

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Method

Homework

Integration

Instructor will post a weekly reading assignment and chapter homework questions from the Physics and Instrumentation textbook by Sydney Edelman or Sandra Hagen-Ansert on Canvas CMS under files and displayed in the syllabus view. Students will download and print the homework questions. The homework question document will be turned in during the next class meeting. Homework questions will be reviewed in class, students will share one question that they missed with their adjacent classmate. The instructor will clarify any questions or wrong answers in class as a group.

DE Adaptations for MOI

Instructor will post a weekly reading assignment and chapter questions from the Physics and Instrumentation textbook by Sydney Edelman or Sandra Hagen-Ansert on Canvas CMS under files and displayed in the syllabus view. Students will download and print the homework questions. The homework question document will be uploaded before the next class meeting.

Method

Discussion

Integration

The instructor will lead an online web search discussion for a current or historical person from a marginalized group who has made contributions or discoveries to sound physics. The students will participate as a class to share their findings as a group in a classroom discussion: The persons name, contribution or discovery, and 3 facts about this person.

DE Adaptations for MOI

The instructor will post a prompt for an online web search for a current or historical person from a marginalized group who has made contributions or discoveries to sound physics. Students will share their findings in the Discussion board on Canvas CMS: The persons name, contribution or discovery, and 3 facts about this person.

Method

Individual Projects

Integration

At the end of the semester, the instructor will facilitate a student led group presentation and demonstration in the classroom: Students will individually prepare and present a Power Point slide show on a chosen topic of Ultrasound Physics and Instrumentation from chapters 13-24 of the assigned text. Students should include a visual learning tool to demonstrate the location and function of the ultrasound instrumentation knobs to demonstrate a chosen topic. Lastly, complete a demonstration using an ultrasound machine platform keyboard in the classroom lab. Examples of topics for Power Point presentation should include one or more of the following concepts: proper transducer selection, gain optimization, depth, TGC, focal zone, imaging artifacts, and image resolution.

DE Adaptations for MOI

At the end of the semester, the instructor will facilitate a student lead an online group presentation and demonstration. The student will upload a Power Point presentation to Canvas, this will be presented via share screen on Zoom with the class. An image of the ultrasound machine platform keyboard will also be shared via Zoom and presenter will demonstrate which instrumentation (knob/toggle) to use to acquire the goal of their presentation. Examples of topics for Power Point presentation should include one or more of the following concepts: proper transducer selection, gain optimization, depth, TGC, focal zone, imaging artifacts, and image resolution.

Method

Observation and Demonstration

Integration

Using a skills check-off sheet of the required instrumentation, students will demonstrate their knowledge of equipment function and instrumentation on an ultrasound machine in the classroom lab by explaining each required knob and its function to the instructor. Example: gain optimization, depth, TGC, focal zone, frequency.

DE Adaptations for MOI

None, needs to be demonstrated using the ultrasound machine in the campus lab.

Method

Lecture

Integration

The instructor will post power point lectures with Canvas voice-over studio recordings each week in a power point format to instruct students about basic physics and instrumentation concepts. Weekly chapters will include sound physics and instrumentation concepts as listed in the course syllabus.

DE Adaptations for MOI

Power Point lectures and Voice-over lectures will be posted on Canvas CMS. Students will review the power point or voice-over during each week of study and be prepared to participate in an online Zoom to review with the instructor using a Kahoot review quiz each week. The instructor will clarify concepts that students miss on the review quiz.

Method

Observation and Demonstration

Integration

The instructor will demonstrate and guide students using an ultrasound machine to develop hands-on familiarity and enhance concepts of frame rate, artifacts, and pulsed wave doppler that were discussed in class. gain optimization, depth, TGC, focal zone, imaging artifacts, and image resolution.

DE Adaptations for MOI

None, must be demonstrated on the ultrasound machine in the campus lab.

Methods of Evaluation

Method

Other

Integration

Kahoot! quiz can be displayed by instructor in the classroom. Students answer the questions via phone by entering the game pin number. This MOE is a review for students for the prior weeks' concepts and they do not receive a grade for this activity. The MOE is a teaching method to evaluate student understanding as a percentage of the class, so that the instructor can further clarify concepts if the Kahoot! question has wrong answers.
This MOE can also be used as a student self evaluation method to review the prior week concepts. Students do not receive a grade, this prepares them for the online graded quiz.

DE Adaptations for MOE

Kahoot! quiz can be displayed by instructor in a group Zoom session or posted as an individual concept review quiz for each student. Students answer the questions via phone by entering the game pin number. This MOE is a review for students for the prior weeks' concepts and they do not receive a grade for this activity. The MOE is a teaching method to evaluate student understanding as a percentage of the class, so that the instructor can further clarify concepts if the Kahoot! questions have wrong answers.
This MOE can also be used as a student self evaluation method to review the prior week concepts. Students do not receive a grade, this prepares them for the online graded quiz.

Method

Homework

Integration

Instructor will post a weekly reading assignment and chapter homework questions from the Physics and Instrumentation textbook by Sydney Edelman or Sandra Hagen-Ansert on Canvas CMS under files and displayed in the syllabus view. Students will download and print the homework questions. The homework question document will be turned in during the next class meeting. Homework questions will be graded for correctness and reviewed in class, students will share one question that they missed with their adjacent classmate and discuss why they may have answered incorrectly. The instructor will clarify any questions or wrong answers in class as a group.

DE Adaptations for MOE

Instructor will post a weekly reading assignment and chapter questions from the Physics and Instrumentation textbook by Sydney Edelman or Sandra Hagen-Ansert on Canvas CMS under files and displayed in the syllabus view. Students will download and print the homework questions. The homework question document will be uploaded before the next class meeting. Homework will be graded for correctness of multiple choice questions. The instructor will clarify any questions or wrong answers with written feedback on Canvas CMS comments option.

Method

Class Participation

Integration

The instructor will moderate the classroom discussion from an online web search for a current or historical person from a marginalized group who has made contributions or discoveries to sound physics. Students will be evaluated on their willingness to contribute to the discussion earning points for sharing: the persons name, contribution or discovery, and 3 facts about this person. Grades will be posted in Canvas Grade book within a week.

DE Adaptations for MOE

The instructor will post a prompt on Canvas CMS, Discussions board: Conduct an online web search for a current or historical person from a marginalized group who has made contributions or discoveries to sound physics. Students will be evaluated on their willingness to contribute to the discussion earning points for a post that includes: the persons name, contribution or discovery, and 3 facts about this person. Grades will be posted in Canvas Grade book within a week.

Method

Presentations

Integration

At the end of the semester, the instructor will facilitate a student led presentation and demonstration in the classroom: Students will individually prepare and present a Power Point slide show on a chosen topic of Ultrasound Physics and Instrumentation from chapters 13-24 of the assigned text. Students should include a visual learning tool to demonstrate the location and function of the ultrasound instrumentation knobs to demonstrate a chosen topic. Lastly, complete a demonstration using an ultrasound machine platform keyboard in the classroom lab. Examples of topics for Power Point presentation should include one or more of the following concepts: proper transducer selection, gain optimization, depth, TGC, focal zone, imaging artifacts, and image resolution. Feedback will be given in writing in the comments option on CMS. Grades will be posted in Canvas Grade book within a week.

DE Adaptations for MOE

At the end of the semester, the instructor will facilitate a student lead an online presentation and demonstration. The student will upload a Power Point presentation to Canvas, this will be presented via share screen on Zoom with the class. An image of the ultrasound machine platform keyboard will also be shared via Zoom and presenter will demonstrate which instrumentation (knob/ toggle) to use to acquire the goal of their presentation. Examples of topics for Power Point presentation should include one or more of the following concepts: proper transducer selection, gain optimization, depth, TGC, focal zone, imaging artifacts, and image resolution. Feedback will be given in writing in the comments option on CMS. Grades will be posted in Canvas Grade book within a week.

Method

Oral Presentation

Integration

The instructor will evaluate student knowledge of a standard ultrasound machine console by asking them to identify each required knob and demonstrate how its function affects the image optimization Evaluation will be scored and initialed by the instructor using a skills check off sheet.
Evaluation will be done using the rubric: 1. below standard, 2. meets standard, 3. above standard; for each required function identification as the instructor observes the demonstration. Example: gain optimization, depth, TGC, focal zone, and frequency. Feedback will be given in writing in the comments option on CMS. Grades will be posted in Canvas Grade book within a week.

DE Adaptations for MOE

None, evaluation needs to be demonstrated using the ultrasound machine in the campus lab.

Method

Quizzes

Integration

Weekly quizzes will allow students to demonstrate formative learning and evaluate the student's weekly immediate understanding of concepts of ultrasound physics and instrumentation. Concepts include: image frame rate, edge shadow artifacts, nyquist limit, energy gradients in hemodynamics, and bioeffects. Feedback will be given in writing in the comments option on CMS. Grades will be posted in Canvas Grade book within a week.

DE Adaptations for MOE

Quizzes will be given online through Canvas CMS. Students will be graded on correctness. The instructor will clarify in writing, any questions or wrong answers with written feedback on Canvas CMS comments option. Grades will be posted in Canvas Grade book within a week.

Assignments

Assignment Type

Other

In-class and/or outside of class

Outside of class

Formative or Summative

Formative

Assignment

Participate in a weekly online Kahoot review quiz. The quiz will consist of physics concepts for each weeks' chapter as a review and will be played by the entire class.
In the classroom, the overhead projector will display the Kahoot game, using an android or Iphone- log into Kahoot.com, enter game pin number and your name. As each question is displayed, select the correct answer using an android or Iphone. All answers will be displayed anonymously with the fastest time recorded for each question and final game winner's name.

How assignment will be adapted in online format

Kahoot! can be played online as a synchronous Zoom meeting with classmates or as an individual chapter review. Using an android or Iphone to log into Kahoot.com, enter the game pin number and player name. Answer questions in the fastest time to win the game. Answers will be entered via cloud from each phone at students home. The game can be observed or recorded via Zoom

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Assignment Type

Reading

In-class and/or outside of class

Outside of class

Formative or Summative

Formative

Assignment

Complete the weekly reading assignment and chapter questions from the Physics and Instrumentation textbook by Sydney Edelman or Sandra Hagen-Ansert. The document is located on Canvas CMS under files and also displayed in the syllabus view. Download and print the homework questions. The homework question document will be turned in during the next class meeting.

How assignment will be adapted in online format

Instructor will post a weekly reading assignment and chapter questions from the Physics and Instrumentation textbook by Sydney Edelman or Sandra Hagen-Ansert on Canvas CMS under files and displayed in the syllabus view. Download and print the homework questions. The homework question document will be uploaded before the next class meeting.

Assignment Type

Other

In-class and/or outside of class

Outside of class

Formative or Summative

Formative

Assignment

Conduct an online web search for a current or historical person from a marginalized group who has made contributions or discoveries to sound physics. Share your findings as a group in a classroom discussion. Include the following points: The persons name, contribution or discovery, and three facts about this person.

How assignment will be adapted in online format

Conduct an online web search for a current or historical person from a marginalized group who has made contributions or discoveries to sound physics. Share your findings as a group in a classroom discussion. Include the following points: The persons name, contribution or discovery, and three facts about this person.

Assignment Type

Writing

In-class and/or outside of class
Outside of class

Formative or Summative
Summative

Assignment
At the end of the semester, prepare a Power Point presentation on a chosen topic of Ultrasound Physics and Instrumentation from chapters 13-24 of the assigned text. In addition, utilize a visual learning tool to demonstrate the location and function of the ultrasound instrumentation knobs to demonstrate a chosen topic. Complete the demonstration using an ultrasound machine platform keyboard in the classroom lab. Examples of topics for Power Point presentation should include one or more of the following concepts: proper transducer selection, gain optimization, depth, TGC, focal zone, doppler, Nyquist limit, hemodynamics, imaging artifacts, and/or image resolution.

How assignment will be adapted in online format
Upload a Power Point presentation to Canvas, this will be presented via share screen on Zoom with the class. An image of the ultrasound machine platform keyboard will be shared via Zoom and presenter will demonstrate which instrumentation (knob/toggle) to use to acquire the goal of their presentation. Examples of topics for Power Point presentation should include one or more of the following concepts: proper transducer selection, gain optimization, depth, TGC, focal zone, doppler, Nyquist limit, hemodynamics, imaging artifacts, and/or image resolution.

Assignment Type
Other

In-class and/or outside of class
In-class

Formative or Summative
Summative

Assignment
Using a skills check-off sheet of the required instrumentation, demonstrate your knowledge of equipment function and instrumentation on an ultrasound machine in the classroom lab by identifying each required knob and demonstrate how its function affects the image optimization. Example: gain optimization, depth, TGC, focal zone, imaging artifacts, and image resolution.
Students will be scored and initialed by the instructor using a skills check off sheet.
Evaluation will be done using the rubric: 1. below standard, 2. meets standard, 3. above standard; for each required function identification as the instructor observes the demonstration.

How assignment will be adapted in online format
None, needs to be demonstrated using the ultrasound machine in the campus lab.

Assignment Type
Reading

In-class and/or outside of class
Outside of class

Formative or Summative
Formative

Assignment
Weekly chapters will include sound physics and instrumentation concepts as listed in the course syllabus. View Power Point lectures and listen to Voice-over lectures that are posted on Canvas CMS. Review the power point or voice-over during each week of study and be prepared to participate in an online Zoom to review with the instructor using a Kahoot review quiz each week. The instructor will clarify concepts that students miss on the review quiz in the next scheduled face to face class.

How assignment will be adapted in online format

Weekly chapters will include sound physics and instrumentation concepts as listed in the course syllabus. View Power Point lectures and listen to Voice-over lectures that are posted on Canvas CMS. Review the power point or voice-over during each week of study and be prepared to participate in an online Zoom to review with the instructor using a Kahoot review quiz each week. The instructor will clarify concepts that students miss on the review quiz during a synchronous Zoom meeting.

Assignment Type

Writing

In-class and/or outside of class

Outside of class

Formative or Summative

Summative

Assignment

Complete Midterm and final exams at the mid-semester and end of the semester respectively. Exams will be given in a multiple choice and short answer format to assess your ability to retain and process information in physics and instrumentation. Exams will be posted on Canvas CMS under "quizzes" option and listed in the syllabus. Grades will be posted online and feedback from instructor through comments in gradebook option.

How assignment will be adapted in online format

Complete Midterm and final exams at the mid-semester and end of the semester respectively. Exams will be given in a multiple choice and short answer format to assess your ability to retain and process information in physics and instrumentation. Exams will be posted on Canvas CMS under "quizzes" option and listed in the syllabus. Grades will be posted online and feedback from instructor through comments in gradebook option.

Assignment Type

Writing

In-class and/or outside of class

In-class

Formative or Summative

Formative

Assignment

Create a monthly online Kahoot review quiz in groups of two. The quiz will consist of physics concepts for each four weeks' chapter as a review and will be played by the entire class in the face to face meeting.
In the classroom, the overhead projector will display the Kahoot game, using an android or Iphone- log into Kahoot.com, enter game pin number and your name. As each question is displayed, select the correct answer using an android or Iphone. All answers will be displayed anonymously with the fastest time recorded for each question and final game winner's name.

This review will complement the instructors weekly Kahoot quiz by combining multiple chapter concepts and allowing students to work in teams to reinforce physics concepts.

How assignment will be adapted in online format

Kahoot! can be played online as a synchronous Zoom meeting with classmates or as an individual chapter review. Using an android or Iphone to log into Kahoot.com, enter the game pin number and player name. Answer questions in the fastest time to win the game. Answers will be entered via cloud from each phone at students home. The game can be observed or recorded via Zoom

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Assignment Type

Other

In-class and/or outside of class

Outside of class

Formative or Summative

Formative

Assignment

Schedule an initial one-on-one Zoom meeting with instructor by email or Canvas mailbox during the first week of classes; meeting with the instructor will be done to ensure student understanding of course format, grading, and discuss any specific needs you need to be successful in the course.

Hybrid courses will meet at regularly scheduled times (at least 5 times per semester). In class, face to face, meetings will be scheduled according to the syllabus found online under "Syllabus" view on Canvas CMS. Face-to-face meetings will consist of chapter reviews using Kahoot quizzes, practicing skills in the lab, and lab demonstrations for skills check off.

How assignment will be adapted in online format

Schedule an initial one-on-one Zoom meeting with instructor by email or Canvas mailbox during the first week of classes; meeting with the instructor will be done to ensure student understanding of course format, grading, and discuss any specific needs you need to be successful in the course.

Hybrid courses will meet at regularly scheduled times (at least 5 times per semester). In class, face to face, meetings will be scheduled according to the syllabus found online under "Syllabus" view on Canvas CMS. Face-to-face meetings will consist of chapter reviews using Kahoot quizzes, practicing skills in the lab, and lab demonstrations for skills check off.

Course Materials

Textbooks

Edelman, S. (2012). Understanding Ultrasound Physics, 4th Edition ESP. ISBN: 9780962644450
Penny, S.; Fox, T. (2018). Examination Review for Ultrasound: SPI Lippincott Williams & Wilkins. ISBN: 9781496377326
Hagen-Ansert, S. (2022). Textbook of Diagnostic Sonography 9th edition Elsevier.
ISBN: 9780323826495

Class Size Information

Class Size

30

Class Size Category

F - Individualized, skills#based instruction/field practice 30

Diversity and Inclusion

Explain how diversity and inclusion(e.g., gender, culture/race, sexuality, etc.) is infused into the course.

Diversity and inclusion are supported through classroom a research assignment and content that includes images or quotes of women and people from marginalized groups who have made contributions to physics theory and research. Course objectives and learning outcomes are supported through classroom discussions, proper imaging technique and protocols, which are presented to foster knowledge, team work, and patient advocacy in developing future healthcare professionals.

Describe how assignments, instruction, evaluation, course content, and interactions are contextualized for diverse learners promoting an equitable course.

The course resources are presented in multiple forms to offer diverse learning methods to students. Audio learners can utilize voice-over lectures that are posted on Canvas CMS of physics concepts on how images are stored and displayed by using a transducer and the hemodynamics of blood flow. Students can listen to voice-over lectures anywhere and anytime on their phone or laptop computer. Visual learners can utilize power-point diagrams, textbook images, instructor lab demonstrations, and videos that describe the bioeffects and safety of ultrasound; Hands-on learners can utilize the campus lab to practice using doppler, color flow, artifacts, and exam protocols on the campus lab ultrasound machine.

Interactions

Explain how the course will incorporate student-to-student interaction.

This course has a lab component which enhances the classroom discussions with hands-on student interaction in pairs or groups. Assignment example: Create an online Kahoot! Quiz in groups of 2. The quiz will consist of physics concepts for each four weeks' chapters as a review and will be played by the entire class. Collaboration between students enhances student learning by working together as a team to formulate quiz questions and reinforce physics concepts.

Explain how the course will incorporate instructor-to-student interaction.

This course provides opportunities for students to observe instructor demonstrations of knobology, ultrasound machine, transducers, scanning protocols and then practice what was observed. Instructors interact through face-to-face lectures where students may ask questions. The CMS houses announcements, syllabi, voice-over lectures, and course schedule through modules. Instructor uses real-life experience stories during lectures to enhance student learning. Instructor encourages use of office hours or meeting after class if student needs assistance or guidance.

Explain how the course will incorporate student-to-content interaction.

This course has a detailed textbook which acts as a study guide and prepares them to attend the Edelman Physics conference and in passing the ARDMS SPI (Ultrasound Physics and Instrumentation) registry exam for sonographer credentialing. Students study text content, power point, video, and carry out hands-on tasks in the campus lab.

Explain how the course will incorporate student-to-self interaction (metacognitive).

This course provides opportunities for students to think about how they will make a plan that provides the best patient care and diagnostic interpretation from beginning to end of their interaction with each patient they care for. Students are encouraged to reflect on how sound is used to create diagnostic information.

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