Course Competency

SON 2614C Acoustical Physics and Instrumentation 1

Course Description

The course will present a review of fundamental physics and in-depth study of the physical principles of diagnostic ultrasound. Topics discussed include properties of sound waves, interaction of sound waves with matter, generation of ultrasound, and principles of Doppler ultrasound. Prerequisite: SON 1005L.

Course Competency	Learning Outcomes
Competency 1: The student will demonstrate knowledge and comprehension of properties of sound by:	1. Communication 2. Numbers / Data 3. Critical thinking
a. Listing, defining, and differentiating different acoustic variables. b. Reviewing and discussing competencies of basic sonography. c. Discussing sound production. d. Discussing the interaction of sound and matter. e. Discussing the different kinds of waves. f. Identifying that sound is a mechanical wave. g. Defining acoustical propagation properties h. Defining biological effects. i. Identifying acoustical parameters (frequency, period, amplitude, power, intensity, wavelength, propagation speed). j. Discussing how acoustical parameters are related and not related. k. Defining transverse and longitudinal waves. l. Discussing interference (constructive, destructive).	
Competency 2: The student will demonstrate knowledge and comprehension of pulsed sound by:	1. Communication 2. Numbers / Data 3. Critical thinking
a. Defining pulse duration. b. Discussing what determines pulse duration.	

c. Identifying which parameters of pulse wave ultrasound imaging is determined by the operator. d. Identifying the formulas that describe pulse duration, spatial pulse length, pulse repetition period. e. Identifying how the parameters of pulsed sound are related. f. Identifying what pulsed wave parameter can be changed by the sonographer. g. Identifying which knob controls the listening time portion of the pulse repetition period. h. Defining duty factor and discussing how it is calculated (formula for duty factor).	
Competency 3: The student will demonstrate knowledge and comprehension of Intensity by:	1. Communication 2. Numbers / Data 3. Critical thinking
a. Defining and discussing the importance of ALARA (as low as reasonably achievable). b. Defining intensity. c. Defining spatial peak intensity. d. Defining temporal peak intensity. e. Combining spatial and temporal factors.	
Competency 4: The student will demonstrate knowledge and comprehension of the interaction of sound and media by:	1. Communication 2. Numbers / Data 3. Critical thinking
a. Defining decibels and attenuation. Describing attenuation coefficient. Discussing the risk-benefit relationship. Discussing reflection and transmission. Discussing impedance. b. Discussing examples of specular reflectors. c. Discussing specular reflection and diffuse reflection. d. Discussing scattering and Rayleigh scattering. e. Discussing the attenuation of types of media (water, fluid, soft tissue, air, bone, lung). f. Discussing the half-value layer. g. Defining normal incidence and oblique incidence.	

h. Identifying the effect of normal and oblique incidence. i. Discussing the Intensity Reflection Coefficient and Intensity Transmission Coefficient. j. Defining refraction. k. Discussing the physics of refraction defined by Snell's law. l. Identifying Snell's law	
Competency 5: The student will demonstrate knowledge and comprehension of sound beams by:	1. Communication 2. Numbers / Data 3. Critical thinking
a. Identifying and describing the components of a sound beam. b. Differentiating between Near Zone and Far zone. c. Discussing Focal Depth. d. Explaining sound beam divergence. e. Defining types of waves. f. Explaining Huygen's Principle. g. Explaining lateral resolution, its units, and by what it is determined. h. Discussing focusing. i. Differentiating types of focusing.	
Competency 6: The student will demonstrate knowledge and comprehension about resolution by:	1. Communication 2. Numbers / Data 3. Critical thinking
a. Explaining axial resolution and lateral resolution. b. Demonstrating how the controls can improve axial resolution. c. Explaining the association with frequency, pulse duration, pulse length and resolution. d. Explaining the measurement methods of intensity. e. Explaining the intensity and relating this to bioeffects of diagnostic ultrasound.	
Competency 7: The student will demonstrate knowledge and comprehension about display modes by:	1. Communication 2. Numbers / Data 3. Critical thinking

a. Defining A-mode, B-mode, and M-mode. b. Discussing the difference of each mode. c. Discussing the application of each mode.	

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