ULTRASOUND PHYSICS
OB/GYN POINT OF CARE (POC)
ECourse

SUMMARY

This eight module course builds the foundation for understanding and learning Point of Care (POC) OB/GYN ultrasound for midwives, physicians, and health care professional who have a need to practice limited scope OB/GYN ultrasound. This modular eCourse teaches physics from a unique perspective with direct clinical application to ultrasound using many analogies, animations, ultrasound images, and ultrasound videos. Concepts presented include ultrasound and wave fundamentals, imaging fundamentals, ultrasound system controls, image artifacts, basic Doppler theory, PW spectral Doppler, color Doppler, and ultrasound bioeffects and safety. The instructor for this course, Frank Miele, is a dynamic, world-renown lecturer who holds multiple patents in diagnostic ultrasound, with a unique ability to make seemingly difficult concepts come to life and comprehensible.

INSTRUCTOR BIOGRAPHY

Frank Miele, MSEE
President, Pegasus Lectures, Inc., Dallas, Texas

Frank graduated cum laude from Dartmouth College with a triple major in physics, mathematics, and engineering. While at Dartmouth, he was a Proctor Scholar and received citations for academic excellence in comparative literature, atomic physics and quantum mechanics, and real analysis. After co-teaching a course in digital electronics at Dartmouth, Frank was a research and design engineer and project leader, designing ultrasound equipment and electronics for more than ten years at Hewlett Packard Company. Frank also served as the chief scientist and Vice President of Research and Development for a small medical company designing non-invasive hemodynamic based measurements. As a designer of ultrasound, he has lectured across the country to sonographers, physicians, engineers and students on myriad topics.

Frank has authored multiple texts on ultrasound physics, produced multiple educational videos, designed exam simulation programs, as well as created the patented analysis algorithm method and apparatus for evaluating educational performance. Frank has recently produced multiple online ultrasound seminars, focusing on making high quality educational programs affordable and accessible to the domestic and international ultrasound community. He is credited with several ultrasound and medical device patents, trade secrets, and publications.
Module 1: Ultrasound & Sound Wave Fundamentals
Module 1, Ultrasound and Sound Wave Fundamentals, lays the foundation for all of the subsequent modules. Unlike most introductory physics modules, this module directly connects the physics concept to the ultrasound application, making clear not only the concept, but how the concept applies clinically and why it matters. The module uses myriad ultrasound images, demonstrations, and analogies to simplify the underlying physics concepts on which ultrasound is based. Specifically this module answers the questions: what is ultrasound?, how does ultrasound work?, what parameters characterize a wave?, and how do sound waves interact with tissues in the body?

Core Concepts: 1 hr 18 min
Focus Session: 1 hr

Module 2: Ultrasound Imaging Fundamentals
Module 2, Transducers and Image Generation, develops the foundation for understanding the practical and logistical aspects of scanning. The module begins by discussing transducer basics including functionality, transducer types, and image formats. This is followed by multiple animations which demonstrate how ultrasound images are actually generated – including transducer movements (translation, angulation, and rotation), scan planes, image planes, correlation with anatomical planes, and transducer orientation requirements. These concepts are all unified with actual ultrasound cases which illustrate how to determine fetal lie. In the second part of the module, reflection from tissue is discussed as relates to sonographic appearance. Again, ultrasound images are used to reinforce the concepts being taught.

Core Concepts: 48 min
Focus Session: 36 min

Module 3: Ultrasound System Controls: OB/GYN
Third of eight modules, Ultrasound System Controls: OB/GYN, this module reviews the function of the ultrasound system controls, relating each control back to the underlying physic concept taught in the previous two modules. The module covers using the appropriate transmit frequency, transmit power, receiver gain, the use of harmonics, imaging depth, image width, focal depth, compression (dynamic range), presets, automated optimization, screen brightness, and cine loop. Ultrasound images and video loops are used throughout to illustrate the functionality of each control.

Core Concepts: 32 min
Focus Session: 24 min

Module 4: Image Artifacts: OB/GYN
With ultrasound, not everything is as it appears to be. Sometimes, structures appear that do not exist, sometimes structures do not appear that do exist, and sometimes structures appear differently than they really are. When any of these situations occur, artifacts exist in the image. In this module, you will learn what an artifact is as well as the most common artifacts, their causes, and how you recognize these artifacts in the image. Most importantly, by understanding the mechanisms that cause the artifacts, you will recognize the existence of artifacts when they occur and understand what the artifact tells you about the body structures that are causing the artifact.

Core Concepts: 31 min
Focus Session: 24 min
Module 5: Introduction to Doppler Fundamentals
Module 5, Introduction to Doppler Fundamentals, teaches Doppler theory and serves as the foundation for the following two modules on spectral Doppler and color Doppler. Whereas 2D ultrasound images provide grayscale representation of tissues, fluids, and structures, the use of Doppler techniques allows for appreciation and quantification of blood flow. Learning the specific techniques and system controls of Doppler is greatly facilitated by first learning the underlying principles employed in Doppler assessments. Concepts taught in this module include the Doppler Effect, reflection of ultrasound waves from red blood cells, and the principles of spectral Doppler and of color Doppler.

Core Concepts: 41 min
Focus Session: 41 min

Module 6: Introduction to PW Spectral Doppler
Building on the concepts taught in the previous module, Module 6 develops an understanding of the specifics of Pulsed Wave (PW) spectral Doppler. The module begins with an illustration of the information contained in a Doppler spectrum. From here, you will learn how PW Doppler is performed, the importance of the PW Doppler sample volume, and the angle dependence of the spectral Doppler. Once you have learned the fundamentals of PW spectral Doppler, the module reviews the Doppler system controls related to spectral brightness and signal strength, velocity display, low velocity flow, sweep speed, and auto spectral optimization. As with the system controls module, the controls will be taught through direct application on actual Doppler spectrums. Finally, the module reviews spectral characteristics, measurements, and indices. We explore the effects of resistance on spectral Doppler waveform characteristics as are needed for assessments of the umbilical artery.

Core Concepts: 1 hr 22 min
Focus Session: 1hr 5 min

Module 7: Introduction to Color Doppler Ultrasound
Module 7, Introduction to Color Doppler, begins with the basics of color Doppler and how color Doppler images are generated. Once color basics are understood, the color Doppler system controls are reviewed to improve your ability to employ color Doppler in your ultrasound exams. As with 2D and PW Doppler, ultrasound images are used throughout this section to make evident the effects of each color Doppler control. The last part of the module teaches how to interpret flow direction from a color Doppler image as well as the use of color power Doppler.

Core Concepts: 57 min
Focus Session: 43 min

Module 8: Ultrasound Bioeffects and Safety
The official statement by the AIUM regarding the safety of ultrasound is that ultrasound is a very safe modality but that there are some risks. Module 8, Ultrasound Bioeffects and Safety, reviews the concepts of ultrasound safety, bioeffects, and transducer care so that you can minimize the risks as much as possible. Topics discussed include AIUM statements on safety, mechanisms of bioeffects (thermal and mechanical) the ALARA principle, and specifics of transducer care.

Core Concepts: 18 min
Focus Session: 15 min
Ultrasound Physics OB/GYN POC Summary:

Viewing Time: 6.5 hours  
Focus Sessions: 5.0 hours  
CME: This activity is approved for a maximum of 11 SDMS CME credits.

For more information:
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