GROSSMONT COLLEGE

COURSE OUTLINE OF RECORD

Curriculum Committee Approval: 03/22/2022

GCCCD Governing Board Approval: 04/19/2022

CARDIOVASCULAR TECHNOLOGY 110 - PHYSICAL PRINCIPLES OF MEDICINE II

1. Course Number Course Title Semester Units

CVTE 110 Physical Principles of Medicine II 3

Semester Hours 3 hours lecture: 48-54 hours 96-108 outside-of-class hours 144-162 total hours

2. Course Prerequisites

A “C” grade or higher in CVTE 100 and 101 and 102 and 103.

Corequisite

None

Recommended Preparation

None

3. Catalog Description

This course is a continuation of Cardiovascular Technology 100, with emphasis on the physical characteristics of sound, ultrasound, and Doppler ultrasound as utilized in medical diagnostic testing. The course explores the physics involved in the formation, propagation, and reflection of sound and ultrasound, the characteristics of the various types of transducers used in echocardiography and vascular duplex scanning, and the mathematical techniques employed in the use of ultrasound to measure and calculate hemodynamic function indices.

4. Course Objectives

The student will:

a. Describe the principles of amplitude, intensity, frequency and attenuation as they relate to the recording, analysis and measurement of sound, infrasound, ultrasound, and Doppler ultrasound in medical diagnostic testing, in accordance with criteria established by the course text and the instructor.

b. Define the principles of scattering, reflection, refraction, absorption, beam resolution, and spectral analysis as they relate to the recording and analysis of ultrasound in medical diagnostic testing, in accordance with criteria established by the course text and the instructor.

c. Distinguish between mechanical and phased array ultrasonic transducers with regard to the characteristics of sound wave formation and propagation, axial and lateral resolution, attenuation, and pulse repetition frequency, in accordance with criteria established by the instructor and the course text.

d. State the Doppler principle and describe the variables in the Doppler equation and describe the variables influencing and the clinical implications of the Nyquist limit.

5. Instructional Facilities

Standard classroom.

6. Special Materials Required of Student

4 functioncalculator.

7. Course Content

1. Parameters of sound
   1. Frequency
   2. Period
   3. Wavelength
   4. Amplitude
   5. Power
   6. Intensity
2. Piezoelectric effect.
3. Doppler equation.
4. Spectral analysis.
5. Display modes
6. Pulsed waves.
   1. Pulse Duration
   2. Pulse Length
   3. Pulse Repetition Period
   4. Pulse Repetition Frequency
   5. Duty Factor
7. Color Doppler.
8. Nyquist limit/aliasing.
9. Bandwidth.
10. Quality factor.
11. Intensities.
12. Intensity conversions.
13. Beam uniformity coefficient.
14. Interaction of sound and media
    1. Decibels
    2. Attenuation
    3. Reflection
    4. Scattering
    5. Absorption
    6. Incidence
    7. Transmission
    8. Refraction
15. Half intensity depth.
16. Snell’s Law
17. Transducers
    1. Piezoelectric material
    2. Transducer architecture
    3. Types of transducers
18. Sound beams
    1. Beam shape
    2. Huygens principle
    3. Focus
19. Resolution
    1. Axial
    2. Lateral
    3. Temporal
20. Artifacts.
21. Bioeffects
22. Quality assurance
23. Harmonics

8. Method of Instruction

a. Lecture.

b. Class discussion.

9. Methods of Evaluating Student Performance

a. Homework assignments such as word problems where students explain the likelihood of exceeding the Nyquist limit and effect on the spectral display and Color Doppler. With changes in pulses and depth of imaging.

b. Midterm examinations where students demonstrate and prove using equations taught in class the changes in the quality of an ultrasound image as the period of sound, propagation speed and image depth change.

c. Comprehensive final examination.

10. Outside Class Assignments

a. Pre-classassignments such as review of PowerPoint presentations and pre-recorded lecture videos.

b. Instructor-assigned problem-solving exercises including exercises in the text.

11. Representative Text:

1. Representative text(s):

Edelman, Sidney. *Understanding Ultrasound Physics*. Woodlands, TX: ESP Publishers. 4th Edition. 2012.

1. Supplementary texts and workbooks:

None.

Addendum: Student Learning Outcomes

Upon completion of this course, our students will be able to do the following:

a. Apply the principles of ultrasound to the optimization and interpretation of ultrasound images and Doppler in an academic and clinical setting.

b. Pass the American Registry for Diagnostic Medical Sonography (ARDMS) Sonography Principles and Instrumentation (SPI) exam.