GROSSMONT COLLEGE

COURSE OUTLINE OF RECORD

Curriculum Committee Approval: 03/22/2022

GCCCD Governing Board Approval: 04/19/2022

CARDIOVASCULAR TECHNOLOGY 100 – PHYSICAL PRINCIPLES OF MEDICINE I

1. Course Number Course Title Semester Units

CVTE 100 Physical Principles of Medicine I 2

Semester Hours 2 hours lecture: 32-26 total hours 64-72 outside-of-class hours 96-108 total hours

2. Course Prerequisites

Admission to the Cardiovascular Technology Program.

Corequisite

CVTE 101 and 102 and 103.

Recommended Preparation

None

3. Catalog Description

A course in the mathematics and physical principles of medicine specifically applicable to the field of Cardiovascular Technology. Designed for students enrolled in the Cardiovascular Technology Program, the course includes studies in the use of mathematic formulas and physics used to evaluate the hemodynamics of the cardiovascular system.

4. Course Objectives

The student will:

a. Utilize mathematical concepts ofthe metric system, fractions, decimal fractions, fundamental algebraic operations and scientific notation to analyze and calculate the hemodynamics of the cardiovascular system in accordance with criteria specified by the instructor.

b. Analyze and calculate hemodynamic function indices of force, energy, velocity and pressure within the cardiovascular system, given data from cardiac catheterization, echocardiographic or vascular laboratories, in accordance with criteria established by the instructor.

c. Define, calculate and state the clinical application of Poiseuille’s Law, the Law of LaPlace, Reynold’s equation,and the Bernoulli Effect, as used in the evaluation of the cardiovascular system, in accordance with criteria established by the instructor.

d. Define the methods of calculation and the clinical relationships of force,pressure, pressure gradients**,** flow**,** resistance**,** velocity, and areawithin the cardiovascular system in accordance with criteria established by the instructor.

e. Apply the above physics concepts, laws and effects as they pertain to the symptomology associated with cardiac and vascular obstructions and aneurysms as well as in the techniques of detecting the manifestation of these physiological changes.

f. Identify and describe lower extremity deep and superficial venous anatomy.

g. Describe the venous return system including the function of valves, cardiac suction, calf and respiratory pump and the roll of hydrostatic pressure on the function of the system.

h. Describe and analyze basic venous pathology and the conditions resulting from complications.

**i.** State and define the clinical applications of duplex ultrasound, plethysmography in the evaluation of the cardiovascular system in accordance with criteria established by the instructor.

**j.** Define basic physical principles of diagnostic ultrasound and methods of their display, measurement, and analysis.

k. Define, describe, and solve mathematical problems involving the parameters of sound waves.

5. Instructional Facilities

Standard classroom.

6. Special Materials Required of Student

Non-programmable scientific calculator.

7. Course Content

1. Solving/converting units of measurement
   * 1. Metric units
     2. SI (international system)
     3. Imperial units
     4. CGS (centimeter, gram, second)
2. Mathematics/Physics used to evaluate cardiovascular system
   * 1. Pressure
     2. Force
     3. Mass
     4. Starling’s Law
     5. Flow
     6. Pressure gradients
     7. Resistance
     8. Poiseuille’s Law
     9. Velocity
     10. Area
     11. Continuity equation
     12. Reynold’s equation
     13. Law of LaPlace
     14. Bernoulli Effect and equation
3. Mathematics/Physics applied to anatomy
   * 1. Heart valves
     2. Lower extremities
     3. ABI (Ankle Brachial Index)
     4. Segmental studies
     5. Vascular stenoses
     6. Laminar flow
     7. Turbulent flow
     8. Aneurysm
4. Murmur, bruit, thrill
5. Conservation of energy
6. Venous anatomy
7. Venous physiology
   * 1. Cardiac suction
     2. Respiratory pump
     3. Calf pump
     4. Hydrostatic pressure
8. Venous pathology
   * 1. Thrombosis (Virchow’s Triad)
     2. Pulmonary embolism
     3. Valvular insufficiency
9. Plethysmography
10. Parameters of sound waves
    * 1. Compression
      2. Rarefaction
      3. Frequency
      4. Period
      5. Wavelength
      6. Propagation speed

8. Method of Instruction

a. Lecture.

b. Class discussion.

c. Multimedia presentations.

d. Discussion of assigned reading and homework.

9. Methods of Evaluating Student Performance

a. Homework assignments

b. Written exams utilizing math equations, hemodynamic principles, and cardiovascular pathophysiology.

c. Comprehensive final exam.

10. Outside Class Assignments

a. Homework assignments such as word problems based on Poiseuille’s Law or the Law of LaPlace.

b. Assigned reading.

11. Representative Texts

a. Representative Texts:

Edelman, Sidney. Understanding Ultrasound Physics. 4th Edition. ESP Incorporated Texas. 2012.

b. Supplementary texts and workbooks:

Class materials posted on Canvas

Addendum: Student Learning Outcomes

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

* 1. Accurately utilize the metric system andmathematical concepts of fractions, decimals, fundamental algebraic operations, and scientific notation to analyze and calculate the hemodynamics of the cardiovascular system.
  2. Accurately analyze and calculate hemodynamic function indices of force, energy, velocity, area, pressure, Starling’s Law, Poiseuille’s Law, the Law of LaPlace, the Bernoulli effect, the continuity

equation, and Reynold’s equation as used in the evaluation of the cardiovascular system.

* 1. Apply the physics concepts and laws covered in the class to the clinical pathology and hemodynamics seen as cardiovascular technologists in each of the specialty tracks.
  2. Break down and apply the fundamental parameters of sound waves as the basis of ultrasound technology.