GROSSMONT COLLEGE

COURSE OUTLINE OF RECORD

Curriculum Committee Approval: 03/22/2022

GCCCD Governing Board Approval: 04/19/2022

CARDIOVASCULAR TECHNOLOGY 102 – MEDICAL INSTRUMENTATION I

1. Course Number Course Title Semester Units

CVTE 102 Medical Instrumentation I 3

Semester Hours

2 hours lecture: 32-36 hours 64-72 outside-of-class hours 3 hours lab: 48-54 hours 144-162 total hours

2. Course Prerequisites

Admission to the Cardiovascular Technology Program

Corequisite

CVTE 100 and 101 and 103

Recommended Preparation

None

3. Catalog Description

An integrated course in medical electronics and instrumentation for the cardiovascular technology student. The course will emphasize the concepts of electrical safety, the clinical application of electronic instruments and devices used in cardiovascular medicine, and the characteristics, recording, and measurement of bioelectric signals.

4. Course Objectives

The student will:

a. Identifyand implement the basic principles of electrical safety in accordance with criteria established by the instructor.

b. Construct and analyze simple electrical circuits to characterize and measure the concepts of voltage, current, and resistance in accordance with criteria established by the instructor.

c. Describe the electrical properties of induction and capacitance and define their use in the cardiac defibrillator.

d. Describe the basic principles of analog-to-digital conversion; define the Nyquist theorem.

e. Summarize the concepts of measurement theory and the standards of accuracy and precision required in the operation of specified medical electronic instruments in accordance with criteria established by the instructor and the course text.

f. Describe the components and assemble/flush/calibrate the pressure transducer setup for hemodynamic monitoring.

g. Define the components of theElectrocardiogram (ECG) waveform, relating them to cardiac electrical and mechanical activity. Apply electrodes and perform the standard 12-lead ECG.

h. Analyze and interpret ECG rhythm strips.

5. Instructional Facilities

a. Standard classroom.

b. Classroom Laboratory.

6. Special Materials Required of Student

None

7. Course Content

a. Electrical Safety

b. Electricity

1) Conductivity

2) Ohms Law

i. Series

ii. Parallel

3) Circuit Components

i. Voltage Source

ii. Capacitors

iii. Resistors

iv. Switches

c. Measurement Theory

1) Digital Multimeter

2) Bioelectric Signal Properties

3) Graphing

4) Analog to Digital Conversion

i. Sampling rates

ii. Nyquist Theorem

d. Magnetism

1) Magnetic Forces

2) Induction

3) Transformers

4) Electricity Generation

e. Cardiovascular Instrument Chain

1) Invasive

i. Physiologic Monitoring

ii. Whetstone Bridge

iii. Transducer Setup

iv. Defibrillator

2) Ultrasound

i. Pulsed Echo Components

f. Radiation

1) Safety

2) Acquisition versus Fluoroscopy

3) Instrument Chain

g, Aseptic Techniques/Personal Protection Equipment (PPE)

1. Sterile Gowning and Gloving
2. Setting Sterile Field
3. Donning and Duffing PPE

h. Electrocardiogram

1) Rhythm Interpretation

2) 12 Lead Electrocardiogram

8. Method of Instruction

a. Lecture.

b. Class discussion.

c. Multimedia presentations.

d. Laboratory demonstration.

e. Computer simulations.

f. Structured laboratory exercises.

9. Methods of Evaluating Student Performance

a**.** Written examinations.

b. Quizzes based on course content such as circuit components and ECG interpretation.

c. Competency based performance exams such as demonstrating a 12-lead ECG.

d. Comprehensive final examination.

10. Outside Class Assignments

a. Specified readings from texts.

b. Problem-solving homework assignments such as applying Ohm’s Law to parallel and series circuits.

11. Representative Texts

1. Representative text(s):
2. Floyd, Thomas. *Principles of Electric Circuits: Conventional Current Version (What's New in Trades & Technology)*. 10th Edition. Pearson. 2019.
3. Jones, Shirley. *ECG Mastery: Improving your ECG Interpretation Skills*. 2nd Edition. Philadelphia, PA. FA Davis. 2019.

b. Supplementary texts and workbooks:

None

Addendum: Student Learning Outcomes

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

* 1. State and define prescribed concepts associated with the laws that govern electricity and magnetism.
  2. State and define principles electrical safety concepts associated with medical instrumentation in the clinical environment.
  3. Describe the basic components of a simple electrical circuit and define the concepts of resistance, capacitance and inductance.
  4. Describe the principles associated with calibration, measurement, random error, non-random error and their relationship to performing clinical diagnostic tests.
  5. Describe the categories and characteristics of biomedical signal detectors.
  6. Perform laboratory exercises in measurement theory, graphing techniques, and basic electrical circuit analysis.
  7. Use computer software to construct simple electrical circuits and calculate the values for resistance, voltage and current in series and parallel electrical circuits.
  8. Describe the components, calibration techniques and clinical application of the electrocardiograph; and perform, record and calculate prescribed parameters of the standard 12-lead electrocardiogram.