



Western Technical College

## 10605174 Biomedical Science Applications

### Course Outcome Summary

#### Course Information

<b>Description</b>	This course focuses on core biomedical skills, background information, and critical thinking through the Biomedical applications of various sciences. A basic introduction to the concepts/applications of the following topics is included: math tools, optics, magnetism, wave/particle theory, atomic and radiation physics, general chemistry, molecular interactions, reactions, bonding, hydraulics, pneumatics and robotics.
<b>Career Cluster</b>	Science, Technology, Engineering and Mathematics
<b>Instructional Level</b>	Associate Degree Courses
<b>Total Credits</b>	3
<b>Total Hours</b>	72

#### Pre/Corequisites

Prerequisite 10806154 General Physics 1

#### Textbooks

No textbook required.

#### Learner Supplies

Safety Glasses with side eye protection, ANSI Z87.1, Pyramex Venture II or Pyramex OTS. **Vendor:** Campus Shop. Required.

#### Success Abilities

1. Refine Professionalism: Improve Critical Thinking

## Program Outcomes

1. Identify the function and operation of various types of imaging equipment
2. Problem-solve electronic circuits and systems
3. Demonstrate safety precautions and practices with medical equipment
4. Demonstrate professionalism

## Course Competencies

### 1. Examine properties of electromagnetic waves.

#### Assessment Strategies

- 1.1. Experiment
- 1.2. Written Objective Test - score 50% or higher

#### Criteria

*You will know you are successful when*

- 1.1. you identify the waves in the electromagnetic spectrum by wavelength and/or frequency
- 1.2. you identify a spectrum as continuum or bright-line

#### Learning Objectives

- 1.a. Review concepts of wave motion
- 1.b. Review wave properties
- 1.c. Describe the types of waves in the electromagnetic spectrum
- 1.d. Differentiate between continuum and bright-line spectra

### 2. Explore the concepts of quantum physics.

#### Assessment Strategies

- 2.1. Experiment
- 2.2. Written Objective Test - score 50% or higher

#### Criteria

*You will know you are successful when*

- 2.1. you apply the Bohr model of the atom to describe the spectrum of a hydrogen atom
- 2.2. you successfully complete a laboratory experiment involving photon energy as a function of frequency and wavelength

#### Learning Objectives

- 2.a. Investigate the concept of quantization of energy
- 2.b. Examine the characteristics of photons
- 2.c. Calculate photon energy using the Bohr model of the atom
- 2.d. Calculate the wavelength shift due to the Compton effect

### 3. Relate the properties of atomic physics to physical phenomena.

#### Assessment Strategies

- 3.1. Experiment
- 3.2. Written Objective Test - score 50% or higher

#### Criteria

*You will know you are successful when*

- 3.1. you calculate the wavelength of an energetic electron
- 3.2. you create correct electron configurations for elements in the first five rows of the periodic table

#### Learning Objectives

- 3.a. Interpret the wave nature of particles (de Broglie wavelength)
- 3.b. Use quantum numbers to characterize the properties of the electrons in an atom
- 3.c. Produce electron configuration of atoms
- 3.d. Interpret the organization of elements in the periodic table according to quantum numbers and electron

configurations

#### **4. Investigate the ramifications and applications of nuclear physics.**

##### **Assessment Strategies**

- 4.1. Experiment
- 4.2. Written Objective Test - score 50% or higher

##### **Criteria**

*You will know you are successful when*

- 4.1. you use nuclear notation to identify various elements
- 4.2. you convert between the decay rate and the half-life of a radioactive nuclide
- 4.3. you compute the effective dose corresponding to a complex radiation exposure scenario
- 4.4. you successfully complete a laboratory experiment investigating the differences between alpha, beta, and gamma radiation
- 4.5. you successfully complete a laboratory experiment involving nuclear activity as a function of distance from the radioactive source
- 4.6. you successfully complete a laboratory experiment to determine the half-life of a radioactive nuclide

##### **Learning Objectives**

- 4.a. Investigate the structure of the nucleus of an atom
- 4.b. Use nuclear notation to describe nuclei of different atoms
- 4.c. Write balanced radioactive decay reactions
- 4.d. Examine the decay rate, half-life, and exponential decay of radioactive nuclides
- 4.e. Compute effective dose of absorbed radiation energy
- 4.f. Investigate medical applications of radiation and radiation detection devices

#### **5. Investigate optical phenomena.**

##### **Assessment Strategies**

- 5.1. Experiment
- 5.2. Written Objective Test - score 50% or higher

##### **Criteria**

*You will know you are successful when*

- 5.1. you complete ray-tracing diagrams for mirrors and lenses
- 5.2. you complete exercises using the mirror and thin-lens equations
- 5.3. you apply Snell's law to calculate angles of incidence or refraction
- 5.4. you calculate the critical angle for total internal reflection
- 5.5. you calculate the polarization angle
- 5.6. you successfully complete a laboratory experiment involving mirrors and lenses

##### **Learning Objectives**

- 5.a. Characterize light rays and wave fronts
- 5.b. Investigate the reflection of light using the law of reflection, ray tracing diagrams, and the mirror equation for plane and spherical mirrors
- 5.c. Investigate the refraction of light using Snell's law, ray tracing diagrams for thin lenses, and the thin lens equation
- 5.d. Examine total internal reflection and its application to fiber optics
- 5.e. Investigate the interference and diffraction of light
- 5.f. Describe the polarization of light

#### **6. Explore the fundamental aspects of chemistry.**

##### **Assessment Strategies**

- 6.1. Experiment
- 6.2. Written Objective Test - score 50% or higher

##### **Criteria**

*You will know you are successful when*

- 6.1. you balance chemical equations
- 6.2. you determine compounds resulting from ionic and covalent bonding

- 6.3. you perform calculations to determine amounts of reactants and products using balance chemical equations
- 6.4. you successfully complete a laboratory experiment investigating lemon batteries

#### **Learning Objectives**

- 6.a. Review chemical notation, the definitions of elements and compounds, and the structure of the periodic table of the elements
- 6.b. Illustrate chemical reactions using balanced chemical equations
- 6.c. Predict chemical compounds produced by ionic and covalent bonding
- 6.d. Express the basic concepts of organic chemistry
- 6.e. Determine the reactants and products of acid-base reactions
- 6.f. Determine the reactants and products in oxidation-reduction reactions

### **7. Investigate hydraulic principles and components.**

#### **Assessment Strategies**

- 7.1. Experiment
- 7.2. Written Objective Test - score 50% or higher

#### **Criteria**

*You will know you are successful when*

- 7.1. you calculate the forces in a hydraulic jack
- 7.2. you correctly identify hydraulic component symbols
- 7.3. you complete laboratory activities involving models of hydraulic machines

#### **Learning Objectives**

- 7.a. Review the application of Pascal's principle to fluid systems and specifically the hydraulic press
- 7.b. Identify symbols that represent hydraulic components
- 7.c. Examine hydraulic circuits
- 7.d. Explore the characteristics of hydraulic systems and their applications in industries including biomedical technology

### **8. Investigate pneumatic principles and components.**

#### **Assessment Strategies**

- 8.1. Experiment
- 8.2. Written Objective Test - score 50% or higher

#### **Criteria**

*You will know you are successful when*

- 8.1. you use the ideal gas law to solve problems involving gases
- 8.2. you correctly identify pneumatic component symbols
- 8.3. you complete laboratory activities involving models of pneumatic machines

#### **Learning Objectives**

- 8.a. Review the application of the ideal gas law to closed gas systems
- 8.b. Identify symbols that represent pneumatic components
- 8.c. Examine pneumatic circuits
- 8.d. Explore the characteristics of pneumatic systems and their applications in industries including biomedical technology

### **9. Explore principles and applications of the major types of motors.**

#### **Assessment Strategies**

- 9.1. Written Objective Test - score 50% or higher
- 9.2. Experiment

#### **Criteria**

*You will know you are successful when*

- 9.1. you identify the uses for common types of DC and AC motors
- 9.2. you identify the uses for stepper and servo motors
- 9.3. you complete laboratory activities involving motors

### **Learning Objectives**

- 9.a. Explore the fundamental principles of motor operation
- 9.b. Investigate the construction and function of DC and AC motors
- 9.c. Describe the most common types of DC motors and their applications
- 9.d. Describe the most common types of AC motors and their applications
- 9.e. Describe the most common types of stepper motors and their applications
- 9.f. Describe servo motors and their applications