Western Technical College

10605166  Physiology and Bio Medical Instrumentation 2

Course Outcome Summary

Course Information

Description
This course is the second of a two-part series introducing the student to human physiology, anatomy, and medical terminology, as well as the acquisition of biophysical measurements made in the clinical environment. The focus is an in-depth study of neurology, renal/urinary system, respiratory system, and equipment maintenance as well as a brief overview of tissues, lab, and water/pH/electrolytes/miscellaneous topics.

Career Cluster
Science, Technology, Engineering and Mathematics

Instructional Level
Associate Degree Courses

Total Credits
3.00

Total Hours
72.00

Types of Instruction

<table>
<thead>
<tr>
<th>Instruction Type</th>
<th>Credits/Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lecture</td>
<td>2 CR / 36 HR</td>
</tr>
<tr>
<td>Lab</td>
<td>1 CR / 36 HR</td>
</tr>
</tbody>
</table>

Course History

Last Approval Date
9/5/2012

Purpose/Goals

Understand basic human physiological systems.

Explain the human/machine interface including the limitations and inherent need for safety requirements.

Use medical terminology to be able to communicate with medical professionals regarding medical equipment.

This course focuses on topics related to details of the nervous system, details of the respiratory system, details of the urinary system, and basics of the miscellaneous systems.

Target Population

Associate Degree Biomedical Electronics Program Students.
Pre/Corequisites
Prerequisite 10605100 Intro Bio Med Tech
Pre/Corequisite 10660117 DC Circuit Analysis
Prerequisite 10660119 Physiology and Bio Medical Instrumentation 1 OR 10605131 Physiology & Bio Medical Instrumentation 1

Textbooks

605-166 Physiology and Biomedical Instrumentation 2. Western. Publisher: Western. Required.

Bibliography

Core Abilities
1. Apply mathematical concepts.
   Status Active

2. Demonstrate ability to think critically.
   Status Active

3. Demonstrate ability to value self and work ethically with others in a diverse population.
   Status Active

4. Make decisions that incorporate the importance of sustainability.
   Status Active

5. Use effective communication skills.
   Status Active

6. Use technology effectively.
   Status Active

Program Outcomes
1. Utilize knowledge of anatomy, physiology, and medical terminology.
   Status Active

   Summative Assessment Strategies
   1.1. Instructor assessment of Formal Lab Reports, Informal Equipment Reports, Log Entries, Portfolios, Assignments; and Clinical host assessment during Clinical Site Interactions.

   Criteria
   1.1. Use correct medical terminology in verbal and written communications and assignments.

2. Demonstrate understanding of the machine/physiology interface.
   Status Active

   Summative Assessment Strategies
2.1. Formal Lab Reports, Informal Equipment Reports, Log Entries, Portfolios, Assignments, Clinical Site Activities.

Criteria
2.1. Utilize understanding of the scientific principle and characteristics behind the transducer or physiologic interface to analyze or troubleshoot equipment performance.

3. Instruct others in the operation of Biomedical equipment.
   Status Active

Summative Assessment Strategies
3.1. Instructor, clinical workplace staff, and intern host evaluation.

Criteria
3.1. With or without the use of equipment manuals demonstrate the operation and correct application of medical equipment for the purposes of training clinical staff or to evaluate/troubleshoot equipment with particular attention to features that preclude patient injury.

4. Maintain biomedical equipment using test equipment and hand tools.
   Status Active

Summative Assessment Strategies
4.1. Return equipment to functional operation, maintaining equipment aesthetics.

Criteria
4.1. Select the proper test equipment (multi-meters, oscilloscopes, safety analyzers, pressure/flow meters, temperature sensors, watt meters, other), simulators (test lung, patient simulators, other), and hand tools. Interpret manufacturer specifications and apply test/calibration/repair procedures. Dis- and reassemble equipment without damage.

5. Demonstrate basic electronics skills.
   Status Active

Summative Assessment Strategies
5.1. Lab assignments, circuit analysis, equipment test and repair.

Criteria
5.1. Predict analog or digital circuit operation and current, voltage or power values using schematics. Verify predictions by making current, voltage, signal, and resistance measurements. Identify, solder or unsolder components in AC/DC circuits, digital circuits, signal processing circuits, power systems, motor systems, and control circuits.

Course Competencies

1. Explain the human nervous system.
   Domain Cognitive Level Analyzing Status Active

Linked Core Abilities
Demonstrate ability to think critically.
Demonstrate ability to value self and work ethically with others in a diverse population.
Use effective communication skills.

Linked Program Outcomes
Utilize knowledge of anatomy, physiology, and medical terminology.
Demonstrate understanding of the machine/physiology interface.

Assessment Strategies
1.1. Participation in assigned activities including classroom discussions, observation of and responses to interactive in class training, reading materials, and practice questions.
1.2. Skill demonstration in simulated or actual situations.
1.3. Objective tests.

Criteria
Performance will meet expectations when:

1.1. You explain the Central/Peripheral, Somatic/Autonomic/Sensory, and Sympathetic/Parasympathetic nervous system divisions.
1.2. You label the parts of a neuron on a sketch and explain their functions including: soma, dendrites, axon, axon terminals, axon collaterals, axon hillock, synapse, vesicles, myelin sheath, and nodes of Ranvier.
1.3. You include astrocytes, microglia, and oligodendrocytes in your explanation of support cells.
1.4. You include the structure and function of the parts of the central nervous system including sections of the spinal cord, brain lobes, covering layers, brain divisions, ventricular system, and cranial nerves.
1.5. You include descriptions of afferent nerve, efferent nerve, and interneuron.
1.6. You list how neurons are bundled to form nerves.
1.7. You use appropriate nervous system terminology on all assigned activities.

Learning Objectives
1.a. Explain the major divisions of the human nervous system.
1.b. Explain the anatomy of a neuron.
1.c. Explain the nervous system support cells, Glia Cells.
1.d. Explain the anatomy and function of the central nervous system.
1.e. Explain divisions of nerves.
1.f. Describe a nerve.

2. Explain the excitatory nature of the nervous system.

Domain  Cognitive  Level  Analyzing  Status  Active

Linked Core Abilities
- Demonstrate ability to think critically.
- Demonstrate ability to value self and work ethically with others in a diverse population.
- Use effective communication skills.

Linked Program Outcomes
- Utilize knowledge of anatomy, physiology, and medical terminology.
- Demonstrate understanding of the machine/physiology interface.

Assessment Strategies
2.1. Participation in assigned activities including classroom discussions, observation of and responses to interactive in class training, reading materials, and practice questions.
2.2. Skill demonstration in simulated or actual situations.
2.3. Objective tests.

Criteria
Performance will meet expectations when:

2.1. You explain neurons as excitable cells and include the direction and transfer of signals.
2.2. You include the following when describing neuron action potentials: ion channels, membrane potential, Na+/K+/Cl-, neurotransmitters, resting potential, chemical gradient, electrical gradient, diffusion, ion pumps, concentration gradient, equilibrium, nerve impulse, threshold potential, depolarization, depolarization, hyperpolarization, refractory period, propagation speed, and salutatory conduction.
2.3. You include different types of synapses, the anatomy of synapses, excitatory/inhibitory responses, temporal summation, spatial summation, cellular integration, neurotransmitters, and the location of synapses in relation to generating an action potential.
2.4. You use appropriate nervous system terminology on all assigned activities.

Learning Objectives
2.a. Explain the function of a neuron.
2.b. Explain the action potential in a neuron.
2.c. Explain synapse conduction.

3. Investigate medical equipment related to the human nervous system.

Domain  Psychomotor  Level  Practicing  Status  Active

Linked Core Abilities
- Apply mathematical concepts.
- Demonstrate ability to think critically.
Demonstrate ability to value self and work ethically with others in a diverse population. 
Make decisions that incorporate the importance of sustainability. 
Use effective communication skills. 
Use technology effectively. 

Linked Program Outcomes 
Utilize knowledge of anatomy, physiology, and medical terminology. 
Demonstrate understanding of the machine/physiology interface. 
Instruct others in the operation of Biomedical equipment. 
Maintain biomedical equipment using test equipment and hand tools. 
Demonstrate basic electronics skills. 

Assessment Strategies 
3.1. Participation in assigned activities including classroom discussions, observation of and responses to interactive in class training, reading materials, and practice questions. 
3.2. Skill demonstration in simulated or actual situations. 
3.3. Objective tests. 

Criteria 

Performance will meet expectations when: 
3.1. You operate medical equipment that picks up the voltage signals of nerves/muscles relating the equipment blocks to the acquisition of the signals including amplifiers, filters, isolation, and display relating the signal to the body function such as EOG, EEG, other. 
3.2. You operate a EEG pickup and analyze the brain waves frequencies, amplitudes, labels, and state of mind for Delta, Theta, Alpha, and Beta waves including a description of the standard 10-20 montage electrode placement. 
3.3. You describe the name and application of the following equipment related to nerve/muscle signals: EMG/Electromyography, Evoked potential, Bis monitor/Bispectral Index, Nerve Conduction studies. 
3.4. You explain Polysonomography equipment as well as the reasons/results of the study. 
3.5. You explain the following information gathering equipment: ENG/Electronystamography, GSR/galvanic Skin Response, ICP/intracranial Pressure monitor, other. 
3.6. You explain the following treatment equipment: Anesthesia, Ultrasonic Aspirator, ECT/Electroconvulsive Therapy, TENS/Transcutaneous Electrical Nerve Stimulator, PCA/Patient controlled liquid analgesia, Fluid Shunts, other. 
3.7. You use appropriate nervous system terminology on all assigned activities. 

Learning Objectives 
3.a. Obtain electrical nerve/muscle signals electronically. 
3.b. Operate an EOG monitor, Electrooculography 
3.c. Operate an EEG, Electroencephalogram 
3.d. Describe equipment related to nerve/muscle signals. 
3.e. Explain a Polysomnography study. 
3.f. Explain a variety of medical equipment related to obtaining information partially or fully related to the nervous system. 
3.g. Explain a variety of medical equipment related to treating the body partially or fully related to the nervous system. 

4. Explain the human respiratory system anatomy. 

Linked Core Abilities 
Demonstrate ability to think critically. 
Demonstrate ability to value self and work ethically with others in a diverse population. 
Use effective communication skills. 

Linked Program Outcomes 
Utilize knowledge of anatomy, physiology, and medical terminology. 
Demonstrate understanding of the machine/physiology interface. 

Assessment Strategies 
4.1. Participation in assigned activities including classroom discussions, observation of and responses to interactive in class training, reading materials, and practice questions.
4.2. Skill demonstration in simulated or actual situations.
4.3. Objective tests.

Criteria

Performance will meet expectations when:

4.1. You include the following anatomy: lobes, airway, different parts of the airway, alveoli/alveolus/alveolar sac, respiratory zone, pleura and related components, blood supply, mediastinum, thoracic, and inspirationexpiration muscles.
4.2. You explain the structure and list the function of the respiratory zone components: squamous epithelium, macrophage, surfactant, respiratory membrane, diffusion, basement membranes, alveolar anatomy, and blood supply.
4.3. You provide details about the cardiopulmonary and systemic circulation.
4.4. You explain gas exchange by using partial pressures, percentages of gasses, and gas transportation.
4.5. You relate lung pathologies to the anatomic defects and relate the results using flow loops, test result values.
4.6. You use appropriate respiratory system terminology on all assigned activities.

Learning Objectives

4.a. Explain respiratory anatomy.
4.b. Explain details of the respiratory zone anatomy.
4.c. Describe the relationship between the heart and lungs.

5. **Explain the human respiratory system function.**

   Domain: Cognitive  
   Level: Analyzing  
   Status: Active

Linked Core Abilities
Demonstrate ability to think critically.
Demonstrate ability to value self and work ethically with others in a diverse population.
Use effective communication skills.

Linked Program Outcomes
Utilize knowledge of anatomy, physiology, and medical terminology.
Demonstrate understanding of the machine/physiology interface.

Assessment Strategies

5.1. Participation in assigned activities including classroom discussions, observation of and responses to interactive in class training, reading materials, and practice questions.
5.2. Skill demonstration in simulated or actual situations.
5.3. Objective tests.

Criteria

Performance will meet expectations when:

5.1. Your explanation of pressures includes absolute pressure, gauge pressure, differential pressure, relative pressure, atmospheric pressure and related pressure units Atm, mmHg, in Hg, cm H2O, KPa, lb/in2.
5.2. You define the following terms: respiration, ventilation, flow, effort, inspiration, expiration, and gradient
5.3. You use appropriate body system terminology on all assigned activities.
5.4. You determine values and explain phenomenon using the following gas laws: Boyle’s, Charles, Dalton’s, Poiseuille’s, Frick’s, Henry’s, and Graham’s.
5.5. You describe laminar, turbulent, and shearing flows and relate that to airway and ventilator flows.
5.6. You explain breathing including the action of the respiratory muscles, compliance, resistance, atmospheric/intrapulmonary/plural pressures, pneumothorax, airflow, and surface tension.
5.7. You graph pulmonary volumes to compare their relationships.
5.8. You relate respiration control to neurologic and chemical factors.
5.9. You use appropriate respiratory system terminology on all assigned activities.

Learning Objectives

5.a. Explain pressure values.
5.b. Define respiratory terms.
5.c. Analyze values and concepts using the gas laws.
5.d. Describe different types of flows.
5.e. Explain breathing.
5.f. Compare pulmonary volumes.
5.g. Explain gas exchange.
5.h. Explain control of respiration.

6. Investigate medical equipment related to the human respiratory system.

**Domain** Psychomotor  **Level** Practicing  **Status** Active

**Linked Core Abilities**
- Apply mathematical concepts.
- Demonstrate ability to think critically.
- Demonstrate ability to value self and work ethically with others in a diverse population.
- Make decisions that incorporate the importance of sustainability.
- Use effective communication skills.
- Use technology effectively.

**Linked Program Outcomes**
- Utilize knowledge of anatomy, physiology, and medical terminology.
- Demonstrate understanding of the machine/physiology interface.
- Instruct others in the operation of Biomedical equipment.
- Maintain biomedical equipment using test equipment and hand tools.
- Demonstrate basic electronics skills.

**Assessment Strategies**
6.1. Participation in assigned activities including classroom discussions, observation of and responses to interactive in class training, reading materials, and practice questions.
6.2. Skill demonstration in simulated or actual situations.
6.3. Objective tests.

**Criteria**
*Performance will meet expectations when:*
6.1. You analyze the functional blocks of a ventilation detection monitor and the different methodologies that equipment can use to detect breathing.
6.2. You analyze a variety of equipment that can monitor or indicate blood gas values.
6.3. You use the test equipment to determine function of respiratory therapy equipment.
6.4. You include details about different ventilator function, controls, and categories.
6.5. You use test equipment to investigate the effects of different lung pathologies.
6.6. You explain the name and function and theory of operation of the therapeutic and diagnostic respiratory equipment.
6.7. You use appropriate respiratory system and electronic terminology on all assigned activities.

**Learning Objectives**
6.b. You operate blood gas indicators.
6.c. You use test equipment related to testing respiratory equipment.
6.e. You explain the function of a variety of therapeutic and diagnostic respiratory equipment.

7. Explain the human renal/urinary system.

**Domain** Cognitive  **Level** Analyzing  **Status** Active

**Linked Core Abilities**
- Demonstrate ability to think critically.
- Demonstrate ability to value self and work ethically with others in a diverse population.
- Use effective communication skills.

**Linked Program Outcomes**
- Utilize knowledge of anatomy, physiology, and medical terminology.
- Demonstrate understanding of the machine/physiology interface.

**Assessment Strategies**
7.1. Participation in assigned activities including classroom discussions, observation of and responses to
interactive in class training, reading materials, and practice questions.

7.2. Skill demonstration in simulated or actual situations.
7.3. Objective tests.

Criteria

Performance will meet expectations when:

7.1. You are able to label anatomy of the kidney, nephron, and urinary system.
7.2. You describe the actions taking part in the nephron and the related control mechanisms.
7.3. Explain the function and different types of dialysis.
7.4. You use appropriate renal/urinary system terminology on all assigned activities.

Learning Objectives

7.a. Explain the anatomy of the renal/urinary system.
7.b. Explain the function of the renal/urinary system.
7.c. Explain dialysis.

8. **Explain homeostasis especially related to body fluids, electrolytes, and acid base balance.**

*Domain* Cognitive  *Level* Analyzing  *Status* Active

Linked Core Abilities

Demonstrate ability to think critically.
Demonstrate ability to value self and work ethically with others in a diverse population.
Use effective communication skills.

Linked Program Outcomes

Utilize knowledge of anatomy, physiology, and medical terminology.
Demonstrate understanding of the machine/physiology interface.

Assessment Strategies

8.1. Participation in assigned activities including classroom discussions, observation of and responses to interactive in class training, reading materials, and practice questions.
8.2. Skill demonstration in simulated or actual situations.
8.3. Objective tests.

Criteria

Performance will meet expectations when:

8.1. You include the roles water plays in the body.
8.2. You include the action of electrolytes on body chemistry and control and homeostasis.
8.3. You include the action of acids/bases/buffers on body chemistry and control and homeostasis.
8.4. You use appropriate chemistry related terminology on all assigned activities.

Learning Objectives

8.a. Explain body fluids.
8.b. Explain electrolytes in the body.
8.c. Explain Acid/Base in the body.

9. **Explain human tissues.**

*Domain* Cognitive  *Level* Analyzing  *Status* Active

Linked Core Abilities

Demonstrate ability to think critically.
Demonstrate ability to value self and work ethically with others in a diverse population.
Use effective communication skills.

Linked Program Outcomes

Utilize knowledge of anatomy, physiology, and medical terminology.
Demonstrate understanding of the machine/physiology interface.

Assessment Strategies

9.1. Participation in assigned activities including classroom discussions, observation of and responses to interactive in class training, reading materials, and practice questions.
9.2. Skill demonstration in simulated or actual situations.
9.3. Objective tests.

Criteria

Performance will meet expectations when:

9.1. You include the name, job, and list of different tissues for each tissue type.
9.2. You include the composition and function of blood and the pathologies that can exist.
9.3. You explain lab equipment based on the method used to determine lab values.
9.4. You list a variety of lab equipment stating its name and function.
9.5. You use appropriate pathology or chemistry terminology on all assigned activities.

Learning Objectives

9.a. Explain the function of different types of tissues.
9.b. Explain details of blood.
9.c. Explain lab equipment.

10. Maintain a variety of types of medical equipment.

Domain Psychomotor Level Practicing Status Active

Linked Core Abilities

Apply mathematical concepts.
Demonstrate ability to think critically.
Demonstrate ability to value self and work ethically with others in a diverse population.
Make decisions that incorporate the importance of sustainability.
Use effective communication skills.
Use technology effectively.

Linked Program Outcomes

Utilize knowledge of anatomy, physiology, and medical terminology.
Demonstrate understanding of the machine/physiology interface.
Instruct others in the operation of Biomedical equipment.
Maintain biomedical equipment using test equipment and hand tools.
Demonstrate basic electronics skills.

Assessment Strategies

10.1. Participation in assigned activities including classroom discussions, observation of and responses to
interactive in class training, reading materials, and practice questions.
10.2. Skill demonstration in simulated or actual situations.
10.3. Objective tests.

Criteria

Performance will meet expectations when:

10.1. You maintain a piece of medical equipment by finding appropriate test procedures in the equipment
documentation, following the procedures using appropriate test equipment.
10.2. You determine if a piece of medical equipment is functioning correctly by verifying equipment meets
specifications in the documentation by test equipment results and functional results.
10.3. You are able to identify any faults of a piece of medical equipment and determine a course of action to
correct the fault.
10.4. You are able to analyze a piece of equipment to determine if it could potentially harm a patient and
determine that safety features are working.
10.5. You use appropriate body system terminology on all assigned activities.
10.6. Use a lab report to present results of testing medical equipment when assigned.
10.7. Your lab report adheres to format presented in previous class including cover page, purpose, equipment,
procedure, data, analysis, and conclusion.
10.8. Your lab report requires specific concrete statements of clear information using correct grammar and
must answer specific lab questions.
10.9. You use appropriate electronic and medical terminology on all assigned activities.

Learning Objectives

10.a. Use test equipment.
10.b. Obtain procedures from equipment manuals.
10.c. Follow described test procedures to determine if a piece of equipment passes inspection.
10.d. Relate the equipment to maintaining patient safety.
10.e. Troubleshoot faults in equipment.

Academic Honesty

Teamwork is strongly encouraged. Plagiarism is not teamwork. Cheating is not academic honesty. Violation of the academic dishonesty policy will be subject to disciplinary action possibly ranging from receiving a zero on a piece of work to being expelled from the school depending upon the nature of the violation(s). Please be aware of what constitutes academic dishonesty and the disciplinary actions as defined in the WTC Student Handbook. http://www.westerntc.edu/student_handbook/StudentPlanner.pdf

All work is expected to be your own. Credit must be given for any quotes, web excerpts and illustrations, and for assistance from other students or instructors.