



TENNESSEE DEPARTMENT OF

**EDUCATION**

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## Diagnostic Medicine

<b>Primary Career Cluster:</b>	Health Science
<b>Consultant:</b>	Sheila Carlton, (615) 532-2839, <a href="mailto:Sheila.Carlton@tn.gov">Sheila.Carlton@tn.gov</a>
<b>Course Code(s):</b>	5994
<b>Prerequisite(s):</b>	Health Science Education
<b>Credit:</b>	1
<b>Grade Level:</b>	10-11
<b>Graduation Requirements:</b>	This course satisfies one of three credits required for an elective focus when taken in conjunction with other Health Science courses.
<b>Programs of Study and Sequence:</b>	This is the second course in the <i>Biotechnology Research and Diagnostic Services</i> programs of study.
<b>Necessary Equipment:</b>	Equipment lists can be found at <a href="http://www.tn.gov/education/cte/HealthScience.shtml">http://www.tn.gov/education/cte/HealthScience.shtml</a> .
<b>Aligned Student Organization(s):</b>	HOSA: <a href="http://www.tennesseehosa.org">http://www.tennesseehosa.org</a> Amanda Hodges, (615) 532-6270, <a href="mailto:Amanda.Hodges@tn.gov">Amanda.Hodges@tn.gov</a>
<b>Coordinating Work-Based Learning:</b>	If a teacher has completed work-based learning training, he or she can offer placement in Job Shadowing or Clinical Internship. For more information, please visit <a href="http://www.tn.gov/education/cte/wb">http://www.tn.gov/education/cte/wb</a> .
<b>Available Student Industry Certifications:</b>	None
<b>Dual Credit or Dual Enrollment Opportunities:</b>	There are no dual credit/dual enrollment opportunities for this course, contact your local postsecondary institution to establish an articulation agreement.
<b>Teacher Endorsement(s):</b>	577
<b>Required Teacher Certifications/Training:</b>	None
<b>Teacher Resources:</b>	<a href="http://www.tn.gov/education/cte/HealthScience.shtml">http://www.tn.gov/education/cte/HealthScience.shtml</a>

### Course Description

*Diagnostic Medicine* is a second-level course designed to prepare students to pursue careers in the fields of radiology, medical laboratory, optometry, and other patient diagnostic procedures. Upon completion of this course, a student proficient in *Diagnostic Medicine* will be able to describe new and evolving diagnostic technologies, compare and contrast the features of healthcare systems, explain the legal and ethical ramifications of the healthcare setting, and begin to perform foundational healthcare skills. In

addition, students will continue to add artifacts to a portfolio, which will carry with them throughout the program of study. This course will serve as a strong foundation for all of the *Diagnostic Services* and *Biotechnology Research* programs of study. Standards in this course are aligned with Tennessee State Standards in English Language Arts & Literacy in Technical Subjects, Tennessee State Standards in Physics, and Tennessee State Standards in Anatomy & Physiology.\*

## Program of Study Application

This is the second course in the *Biotechnology Research* and *Diagnostic Services* programs of study. For more information on the benefits and requirements of implementing these programs in full, please visit the Health Science website at <http://www.tn.gov/education/cte/HealthScience.shtml>.

## Course Standards

### Career Planning and Professionalism

- 1) Revise the career information portfolio developed in the *Health Science Education* course and update with more in-depth information surrounding careers in diagnostic sciences. Identify specific roles and responsibilities for each career in this field. Investigate and compare the range of skills, competencies, and professional traits required for such careers. Compare findings to current individual strengths and identify opportunities for personal development. (TN Reading 1, 2; TN Writing 2, 9)
- 2) Summarize the Health Insurance Portability and Accountability Act (HIPAA), in particular those aspects related to maintaining confidentiality, patient rights, patient safety, and other ethical/legal directives governing medical treatment. Using medical terminology and accurate definitions of legal concepts, explain how the content of these ethical/legal ramifications affects patients' rights for all aspects of care. (TN Reading 1, 2, 4, 5; TN Writing 2)

### Technology

- 3) Differentiate between telemedicine and telehealth. Identify the areas in which telehealth and/or telemedicine are being utilized nationally and globally with success. Describe in a written, verbal, or digital format what barriers currently exist to implementing such technologies on a larger scale, and outline any initiatives that can be incorporated to reduce the barriers. (TN Reading 2, 4, 9; TN Writing 2, 6, 8)
- 4) Investigate and document the history of radiology, medical laboratories, and other related areas of diagnostic medicine. Explain how technology is influencing the future of each. Synthesize research from professional journals and other medical or technical literature to analyze the barriers to these technologies and predict how the industry might respond. (TN Reading 1, 2, 8, 9; TN Writing 7, 8, 9)
- 5) Synthesize information from professional journals and digital resources to investigate the use of robotics in healthcare other than in surgical procedures. Develop a proposal, sketch, mock press release, or similar written artifact for a new technology or an improvement to a current technology that can be used in the field of diagnostics. Detail all the specifications of the new technology, including an explanation of how the technology will be used, the projected cost-



saving measures, and the most applicable professions that would use the technology. (TN Reading 1, 2, 4, 7, 9; TN Writing 2, 4, 5, 8, 9)

- 6) Evaluate data from research articles encompassing the reliability of home testing kits (i.e., pregnancy test) and portable diagnostic equipment (i.e., glucometers). Explain findings in an informational essay, citing at least three different peer-reviewed articles and including appropriate medical terminology. (TN Reading 1, 2, 4, 8; TN Writing 2, 9)

### **Safety**

- 7) Obtain medical laboratory manuals from at least three different resources or physical laboratory sites. Identify the elements of containment regarding general infection control, chemistry precautions, fire safety, chemical hazards, electrical safety, mechanical safety, general lab safety, accident exposure, and disaster preparedness. Develop a written or digital lab manual for a medical laboratory at school based on findings from the research. (TN Reading 2, 4, 5, 9; TN Writing 4, 6, 8, 9)
- 8) Research the guidelines pertaining to radiation safety for staff, patients, and family who are receiving any radiological procedure. Develop an informational artifact, public service announcement, or health education presentation that instructs patients/clients on what patients should know about medical radiation safety. (TN Reading 3, 4, 9; TN Writing 2, 6, 9)
- 9) Explore policies and procedures related to diagnostic equipment quality control monitoring and evaluation. Synthesize information into a digital or written presentation to instruct appropriate staff on the importance of implementing quality control processes according to policy. (TN Reading 3, 4, 9 ; TN Writing 2, 6, 8, 9)

### **Infection Control/Medical Microbiology**

- 10) Demonstrate mastery of concepts and skills related to asepsis, Universal Precautions, sanitation, disinfection, and sterilization for patient/client care settings in adherence to standards and guidelines from the Centers for Disease Control and Prevention (CDC) and the Occupational Safety and Health Administration (OSHA) in a lab/clinical setting. (TN Reading 3)
- 11) Define the term normal flora and explain how its deviation can prevent or cause a disease or disorder. Outline specific preventive measures to align to acceptable standards of care in the healthcare field. (TN Reading 4; TN Writing 4; TN A&P 5)
- 12) Assess the differences between healthcare-associated infections and non-healthcare-associated infections using examples drawn from mock patient documents or case studies. Support explanations with relevant surveillance statistics, preventive measures, and methodologies concerning outbreak detection, management, and education. (TN Reading 1, 3, 4; TN Writing 4, 7, 9)

### **Diagnostic Radiology**

- 13) Outline the in-depth normal structure and function of the musculoskeletal, nervous, and respiratory systems, specifically as they relate to radiology. Review directions, planes, and



sections of the body in order to perform radiographic images. Summarize appropriate medical text(s) in order to list signs and symptoms of common diseases and disorders associated with each. (TN Reading 1, 2, 3, 4, 9; TN Writing 9; TN A&P 2, 3)

14) Distinguish between the various types of diagnostic radiology, citing the uses, advantages, and disadvantages of each. Develop an explanation that would be used for beginning health science students, incorporating appropriate industry and medical terminology. (TN Reading 2, 4, 9; TN Writing 2, 4)

15) Research the principles of radiographic physics and explain how the concepts are applied to produce high-quality radiographic images. Discuss the following in the explanation:

- a. Electromagnetic spectrum and ionizing radiation
- b. Properties of X-rays
- c. Production of X-rays
- d. The X-ray tube and other parts of an X-ray machine
- e. Factors affecting the quality and intensity of beam
- f. Interaction of X-rays with matter

(TN Reading 2, 4, 9; TN Writing 2, 8, 9; TN Physics 5)

16) Identify the equipment used in radiographic imaging. Describe in a written, oral, or digital format the following:

- a. Properties of a radiographic film and the process related to the formation of a radiographic image
- b. Effects of exposure factors on the film
- c. Uses of cassettes and intensity screens
- d. Implications of these and other considerations on the quality of a diagnostic radiograph

(TN Reading 4, 5; TN Writing 2; TN Physics 5, 6)

17) Understand principles of and successfully perform interpretation skills for radiographic images, incorporating rubrics from textbooks or clinical standards of practice. Identify any anatomical abnormalities and document findings per industry standards related to terminology and format. (TN Reading 3, 4; TN Writing 7; TN A&P 2)

### **Clinical Laboratory**

18) Outline the in-depth normal structure and function of blood and related components.

Summarize appropriate medical text(s) in order to list signs and symptoms of common blood diseases and disorders associated with each. Define the following common laboratory procedures, both normal and abnormal, and provide the reasoning for why the test should be obtained:

- a. Complete Blood Count
- b. Complete Metabolic Panel
- c. Fasting Lipid Panel
- d. Hgb A1C

(TN Reading 3, 4, 9; TN Writing 8, 9; TN A&P 4)

19) Develop a graphic organizer or concept map to explain the functions of the various departments of a medical laboratory, such as microbiology, chemistry, hematology, blood banking, and



urology. Include types of fluid samples and test that are performed in each area with a detail of the precautions involved when handling each. (TN Reading 3, 4; TN Writing 6)

- 20) Understand principles of and successfully perform skills of a phlebotomist, incorporating rubrics from National HOSA, textbooks, or clinical standards of practice.
- Distinguish sites and/or veins for blood draws in all populations using the required equipment and safety precautions.
  - Perform collection procedures for microspecimens and venipuncture on a mannequin using appropriate collection containers and identifying factors affecting collection/test results.
  - Provide guidelines for obtaining blood from neonates, pediatrics, and geriatrics.
  - Perform skills of patient/specimen identification and transporting of specimens.
- (TN Reading 3, 4)

### **Ophthalmological Procedures**

- 21) Outline the in-depth normal structure and function of the eye. Summarize appropriate medical text(s) in order to list signs and symptoms of common diseases and disorders associated with each. (TN Reading 2, 4, 9; TN Writing 8, 9; TN A&P 3)
- 22) Understand principles of and successfully perform skills related to basic ophthalmic examination, incorporating rubrics from textbooks or clinical standards of practice. Measure pulse and blood pressure, and conduct a history and physical, especially concerning areas related to the eye. (TN Reading 2, 4; TN Writing 8, 9; TN A&P 3)
- 23) Research the concepts surrounding measurement of visual acuity with associated equipment, and explain corrective measures for abnormalities (i.e., surgery, glasses, or contacts). Specify what measures should be used with each abnormality. (TN Reading 2, 3, 4, 5)
- 24) Develop a policy and procedure guide for a clinic dealing with frame dispensing, frame alignment and adjustment, and use of a lensometer. Perform skills of assisting a patient to choose the correct frames and correctly adjust for optimal wear. (TN Reading 3, 4)

### **Special Studies/Procedures**

- 25) Compare and contrast the costs of basic and advanced procedures in each of the following areas of diagnostic medicine: radiological, medical laboratory, diagnostic cardiovascular, gastrointestinal, and respiratory. Explain the purpose for each procedure and distinguish among situations in which a diagnostician would recommend an advanced procedure versus situations in which the basic procedure would be sufficient. Justify the need for the more advanced procedure as would a diagnostician explaining options to a paying patient. (TN Reading 2, 3, 4, 9; TN Writing 4, 6, 8, 9)
- 26) Generate a digital or written artifact explaining the diagnostic procedures related to gastrointestinal, cardiovascular, pulmonary, and neurological disorders. Include in the explanation the anatomy involved with the procedure, the type of procedure (i.e., invasive or non-invasive), the reason for the procedure, the healthcare staff that will be assisting or performing the procedure, precautions related to the procedure, and any specific patient



teaching that should occur prior to administering the procedure. (TN Reading 1, 2, 4, 8; TN Writing 2, 6, 9)

## Portfolio

27) Update materials from coursework to add to the portfolio started in *Health Science Education*. Continually reflect on coursework experiences and revise and refine the career plan generated in the prior course. The following artifacts will reside in the student's portfolio:

- a. Career Exploration portfolio
- b. Skills performance rubrics
- c. Documentation of job shadowing hours
- d. Examples of written, oral, or digital presentations
- e. Short research project documents

(TN Writing 2, 4)

## Standards Alignment Notes

\*References to other standards include:

- TN Reading: [Tennessee State Standards for English Language Arts & Literacy in History/Social Studies, Science, and Technical Subjects](#); Reading Standards for Literacy in Science and Technical Subjects 6-12; Grades 9-10 Students (page 62).
  - Note: While not directly aligned to one specific standard, students who are engaging in activities outlined above should be able to also demonstrate fluency in Standard 10 at the conclusion of the course.
- TN Writing: [Tennessee State Standards for English Language Arts & Literacy in History/Social Studies, Science, and Technical Subjects](#); Writing Standards for Literacy in History/Social Studies, Science, and Technical Subjects 6-12; Grades 9-10 Students (pages 64-66).
  - Note: While not directly aligned to one specific standard, students who are engaging in activities outlined above should be able to also demonstrate fluency in Standards 3 and 10 at the conclusion of the course.
- TN Physics: Tennessee Science: [Physics](#) standards 5 and 6 may provide additional insight and activities for educators.
- TN A&P: Tennessee Science: [Anatomy and Physiology](#) standards 2, 3, 4, and 5 may provide additional insight and activities for educators.
- P21: Partnership for 21st Century Skills [Framework for 21st Century Learning](#)
  - Note: While not all standards are specifically aligned, teachers will find the framework helpful for setting expectations for student behavior in their classroom and practicing specific career readiness skills.
- National Accrediting Agency of Clinical Laboratory Sciences (NAACLS): [Standards for Specific Approved Programs](#)
  - Note: Students must be a completer of a NAACLS approved program in order to sit for a national phlebotomy certification exam.





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## Anatomy and Physiology

<b>Primary Career Cluster:</b>	Health Science
<b>Consultant:</b>	Sheila Carlton, (615) 532-2839, <a href="mailto:Sheila.Carlton@tn.gov">Sheila.Carlton@tn.gov</a>
<b>Course Code(s):</b>	5991
<b>Prerequisite(s):</b>	Prerequisite: <i>Biology I</i> ; pre- or co-requisite: <i>Chemistry I</i>
<b>Credit:</b>	1-2 credits**
<b>Grade Level:</b>	11-12
<b>Graduation Requirements:</b>	This course satisfies one of three credits required for an elective focus when taken in conjunction with other Health Science courses. It can also count as a science credit and is accepted by the NCAA as a science credit course.
<b>Programs of Study and Sequence:</b>	This is the third level course in <i>Biotechnology Research, Diagnostic Services, Therapeutic Nursing Services, Emergency Services</i> , and level four course in <i>Therapeutic Clinical Services</i> programs of study.
<b>Necessary Equipment:</b>	Equipment lists can be found at <a href="http://www.tn.gov/education/cte/HealthScience.shtml">http://www.tn.gov/education/cte/HealthScience.shtml</a> .
<b>Aligned Student Organization(s):</b>	HOSA: <a href="http://www.tennesseehosa.org">http://www.tennesseehosa.org</a> Amanda Hodges, (615) 532-6270, <a href="mailto:Amanda.Hodges@tn.gov">Amanda.Hodges@tn.gov</a>
<b>Coordinating Work-Based Learning:</b>	If a teacher has completed work-based learning training, he or she can offer placement in Job Shadowing. For more information, please visit <a href="http://www.tn.gov/education/cte/work_based_learning.shtml">http://www.tn.gov/education/cte/work_based_learning.shtml</a> .
<b>Available Student Industry Certifications:</b>	None
<b>Dual Credit or Dual Enrollment Opportunities:</b>	There are dual credit/dual enrollment opportunities for this course. For more information, reach out to a local postsecondary institution to establish an articulation agreement.
<b>Teacher Endorsement(s):</b>	577
<b>Required Teacher Certifications/Training:</b>	None
<b>Teacher Resources:</b>	<a href="http://www.tn.gov/education/cte/HealthScience.shtml">http://www.tn.gov/education/cte/HealthScience.shtml</a>

### Course Description

*Anatomy and Physiology* is an upper level course designed to prepare students in developing an understanding of the structures and functions of the parts of the human body, while relating those to



knowledge and skills associated with pathophysiology. Upon completion of this course, a student proficient in *Anatomy and Physiology* will be able to (1) apply the gross anatomy from earlier courses to a deeper understanding of all body systems, (2) identify the organs and structures of the support and movement systems, (3) relate the structure and function of the communication, control, and integration system, and (4) demonstrate a professional, working understanding of the transportation, respiration, excretory, and reproduction systems. Standards in this course are aligned with Tennessee State Standards for English Language Arts & Literacy in Technical Subjects, Tennessee State Standards in Biology II, Anatomy and Physiology, and Chemistry II, and Advanced Placement Biology standards.\*

## Program of Study Application

This is the upper level course in the Biotechnology Research, Diagnostic Services, Therapeutic Nursing Services, Emergency Services, and Therapeutic Clinical programs of study. For more information on the benefits and requirements of implementing these programs in full, please visit the Health Science website at <http://www.tn.gov/education/cte/HealthScience.shtml>.

\*\*Standards marked with the double asterisk (\*\*) serve as extension standards to be taught if course is offered for two credits.

## Course Standards

### Organization of the Human Body

- 1) Review the definition of anatomy and physiology (A&P) from previous courses, identifying the sections, planes, and regions with associated organs in each. In the review, explain using correct medical terminology why the body is organized into systems and how the cellular building blocks (atoms, molecules, cells, and tissue) work together to form each of the organs. (TN Reading 2, 5; TN Writing 4, 9; TN Biology II 1)
- 2) Examine the structures, components, and functions of a typical cell, and explain their actions in movement across cell membranes such as diffusion, osmosis, filtration, active transport, endocytosis, exocytosis, phagocytosis, and pinocytosis. Predict abnormalities that can occur with disorders of cell structures from professional journals or textbooks. (TN Reading 1, 3, 4, 9; TN Writing 9; TN Biology II 1; AP Biology E.U. 2, 3.A)
- 3) Discuss in an oral, written, or digital format the inorganic and organic compounds that are found in living organisms as they are related to chemistry concepts. Describe the consequences if there is a disturbance in any of the following: acid-base balance, change in oxygen and/or carbon dioxide levels, water balance, electrolytes, carbohydrates, lipids, and proteins. (TN Reading 1, 2, 4, 9 ; TN Writing 4; TN Biology II 3)
- 4) \*\*Synthesize in a written, oral, or verbal presentation the composition and actions of deoxyribonucleic acid (DNA), ribonucleic acid (RNA), and adenosine triphosphate (ATP). Determine how DNA is involved in the genetic code, and describe the importance of chromosomes, the function of RNA as a messenger, and the role of ATP. (TN Reading 1, 2, 8 ; TN Writing 2, 4, 9; TN Biology II 3, 4; AP Biology E.U. 3.A)





- 5) \*\*Define the following terms and formulate a hypothesis related to their chromosome aberration abnormalities: polyploidy, tetraploidy, autosomal aneuploidy, sex chromosome aneuploidy, and abnormalities of chromosome structure. (TN Reading 4; TN Biology II 4; AP Biology E.U. 3.A)
- 6) Explain how organisms use positive and negative feedback mechanisms to maintain their internal environment and respond to external environmental changes. Identify possible consequences that can occur if the body does not maintain homeostasis. Summarize how cellular metabolism can affect the body's homeostatic state. (TN Writing 2, 9; TN Writing 4; TN Biology II 5; AP Biology E.U. 2.B)

### Support and Movement

- 7) Create a model with a written, digital, or verbal explanation of the three layers of skin (epidermis, dermis, and subcutaneous). Summarize functions and characteristics of each layer; describe layers within epidermis and dermis; outline and sketch cell types and definitions, appendages, blood supply, innervation, and possible lesions. (TN Reading 2, 4, 7; TN Writing 4, 9; TN Biology II 1)
- 8) Investigate and obtain information on a skin disorder/disease/syndrome from a medical/healthcare journal or textbook. Appraise a sample case study involving review of the A&P of the cells and tissues affected. Decide whether an inflammatory response was involved, identify the causative agent, locate signs and symptoms of the disorder, and relate to normal A&P. (TN Reading 1, 2, 4; TN Writing 4, 9; TN Biology II 1)
- 9) Synthesize information from textbooks or other biological resources on the elements of bone tissue, including bone cells (osteoblasts, osteocytes, osteoclasts), bone matrix (collagen fibers, proteoglycans, cone morphogenic proteins), and glycoproteins (sialoprotein, osteocalcin, calcium, phosphate, alpha-glycoprotein) with the functions of each. Identify bone minerals and determine how they can change these elements during bone development. (TN Reading 1, 2, 4; TN Writing 4, 6, 9; TN Biology II 1)
- 10) Provide an accurate summary of the types of characteristics of bones, drawing on textbooks and digital resources. Examine a model (live, virtual, or graphic) of a bone. Describe how the body maintains bone integrity through remodeling and repair. (TN Reading 4, 5; TN Biology II 1)
- 11) Explain the structure and function of joints in the body by distinguishing among the three classifications (synarthrosis, amphiarthrosis, diarthrosis). Detail the bones involved in each joint, supply examples, and summarize the methods by which joints assist in movement. In addition, be able to locate and describe joint-related structures such as tendons, ligaments, bursae, and cartilage. Summarize what happens to joints when cartilage erodes. (TN Reading 1, 4; TN Writing 2, 9)
- 12) Label on a skeleton the names of the bones for each of the following, identifying points of attachment:
  - a. Skull 22 bones (cranium 8, Facial 14)
  - b. Spinal Column/Vertebra 24 with explanation of three parts of a typical vertebra (body, foramen, and processes)



- c. Thoracic Cavity
- d. Upper extremities: Shoulder girdle, arms, wrist, and hands including long bone processes, and three parts of each finger
- e. Lower extremities: hip girdle, legs, ankles, and feet including long bone parts, and parts of toes

(TN Reading 1)

- 13) Classify the three categories of muscle fibers, differentiating between cells and tissue. Draw evidence from informational texts to explain the locations, behavioral properties, and functional roles unique to each category. Draw on knowledge of biological processes, such as the body's conversion of ATP into energy, to illustrate phenomena such as muscle fatigue. (TN Reading 2, 4; TN Writing 4, 9; TN Biology II 1)
- 14) \*\*Differentiate between the characteristics of white muscle and red muscle fibers, including their relationship to fast-twitch and slow-twitch fibers. Debate in class or in a written or digital format the purpose of these two types of muscle fibers as related to muscle strength, power and endurance for fitness/athletic training, and rehabilitation of muscle. (TN Reading 2, 4; TN Writing 1, 6, 7)
- 15) \*\*Describe the motor unit of the skeletal muscle. Explain how the motor neuron within that motor unit communicates with the muscle cells, how muscle contraction is influenced by protein filaments and the physiological principle of all-or-none law. (TN Reading 2, 4; TN Writing 4; TN Biology II 6)
- 16) Explain the guidelines used in naming skeletal muscles such as location, size, direction, etc. Develop a graphic that identifies the name of the muscle, the directional motion, location, and function of the following muscle groups:
- a. Muscles of facial expressions
  - b. Muscles of mastication
  - c. Muscles of the neck
  - d. Muscles of the trunk and upper extremities
  - e. Muscles of lower extremities
- (TN Reading 2, 4, 6)
- 17) \*\*In an informational essay drawing on multiple peer-reviewed articles, cite the connection between the muscular and skeletal systems, particularly as it concerns posture and movement. (TN Reading 1, 2, 4; TN Writing 2, 4, 9)
- 18) \*\*Research alterations of musculoskeletal function in the areas of skeletal trauma, support structure injuries, metabolic bone diseases, infectious bone diseases, bone tumors, joint disorders, muscle membrane abnormalities, metabolic muscle disease, inflammatory muscle diseases, and/or muscle tumors. Using correct medical terminology, explain in a written, digital, or oral format the following aspects as they relate specifically to musculoskeletal function: abnormal anatomy and/or physiology, pathophysiology, underlying causation, clinical manifestations, evaluation, and treatment. Differentiate between the diseases in a pediatric, adult, and elderly person. (TN Reading 1, 2, 4, 8; TN Writing 1, 6, 9)



## Communication, Control and Integration

- 19) Differentiate between the central nervous system and the peripheral nervous system, detailing the anatomy of each system, important functions, differences between afferent, efferent, and associative neurons, and the different categories of nervous cells and tissue. (TN Reading 1, 4; TN Writing 2, 9, TN Biology II 1)
- 20) Explain the process of action potentials of the nervous system and name the factors that affect the speed at which a nerve impulse travels. Include in your explanation the all-or-none response and substances that can change the transmission such as amino acids, monoamines, acetylcholine, etc. (TN Reading 2, 9; TN Writing 4, 9; TN Biology II 6)
- 21) Describe the location, structures, and primary functions of the anatomical parts of the central nervous system. Explain the importance of cerebral spinal fluid and its connection to circulation, the phenomenon of the blood-brain barrier within the brain, and white and gray matter in the brain. (TN Reading 2, 4; TN Writing 4, 9)
- 22) Describe the location, structures, and primary functions of the anatomical parts of the peripheral nervous system (PNS). Differentiate between the structures and functions of the cranial nerves, spinal nerves, sympathetic nerves, and parasympathetic nerves. Determine how the phenomenon of biofeedback relates to the structures of the PNS. (TN Reading 2, 4; TN Writing 4, 8)
- 23) \*\*Gather relevant information from multiple resources related to how the action of catecholamine will vary with different types of neuroreceptor stimulation. Identify the actions of the autonomic nervous system neuroreceptors, the effector organ or tissue, the adrenergic effect, and the cholinergic effect. Link this information to the processes of vasoconstriction and vasodilation in an informational artifact. (TN Reading 2, 4, 9; TN Writing 4, 8, 9)
- 24) \*\*Complete a literature review of at least three peer-reviewed articles to explain the theories of pain especially in the area of neuroanatomy of pain, pain threshold, and pain tolerance. Include perception of pain in pediatric, the aged, males, and females. Cite the information obtained in an informational essay to share with a focus on addressing the perception with someone in the medical community, using appropriate medical terminology. (TN Reading 1, 2, 4, 6; TN Writing 2, 4, 5)
- 25) Gather information concerning the sensory system. Synthesize the information surrounding the structure and function of the eye, ear, nose, and mouth. Explain the processes of vision, hearing, smell and taste. Conduct a short research project to give details on how these systems are influenced by the nervous system or the muscular system. (TN Reading 1, 2, 8, 9; TN Writing 4, 7)
- 26) Define key terms associated with vision disorders, ear disorders, nose disorders, and mouth disorders. Write a case study based on one of these disorders using appropriate medical terminology describing how a patient would present to physician's office or emergency room. (TN Reading 1, 2, 4, 8, 9; TN Writing 2, 9)



- 27) \*\*Research from medical resources the alterations in function of the eyes, ears, nose, and throat. In a written, digital, or oral format, explain the following using correct medical terminology: a) abnormal anatomy and/or physiology, b) pathophysiology, c) underlying causation, d) clinical manifestations, e) evaluation, and f) treatment. Differentiate between the diseases in an infant, pediatric, adult, and elderly person. (TN Reading 1, 2, 4, 8; TN Writing 2, 8, 9)
- 28) List the structures of the endocrine system, explain the functions of each, describe the hormones related to each structure, and summarize the positive and negative effects on the body. Debate in a written or oral format the effects of human growth hormone use in athletes. (TN Reading 1, 2, 6, 9; TN Writing 1, 4, 9)
- 29) \*\*Research information to explain the pathophysiology and abnormal anatomy and/or physiology surrounding the hypo- and hyper-secretion of hormones of the endocrine system. Explain how these abnormalities can affect one's physical and mental health. Differentiate between the diseases in a pediatric, adult, and elderly person. Develop a public service announcement, community awareness presentation, or health education presentation to inform a selected audience about one of these diseases or disorders using the National HOSA competitive events guidelines. (TN Reading 2, 7, 8; TN Writing 4, 6, 7, 9)

### Transportation and Defense

- 30) Identify the liquid and cellular components of blood using appropriate medical terminology. Summarize the structural characteristics, normal levels, function, and life span of each. Evaluate the information to explain how and where each component is manufactured (i.e., as with hematopoiesis and erythropoiesis) and what happens if there are complications with the development. (TN Reading 1, 4, 9 ; TN Writing 9; TN Biology II 1)
- 31) \*\*Define hemostasis and explain the related mechanisms that involve the vasculature, platelets, and blood proteins. Relate how clotting factors assist with hemostasis and complications that arise if there is an abnormality with one of these factors. (TN Reading 1, 2, 5; TN Writing 4)
- 32) Illustrate in a digital or 3D format the process of inflammation that occurs when tissue has been damaged in the body. Synthesize the inflammatory response process within the circulatory system using medical terminology, then translate information into a brochure that can be provided to a pediatric or geriatric patient. Use phrases and explanations that can be easily understood by each group. (TN Reading 2, 4, 7, 9; TN Writing 6)
- 33) Describe the roles of antigens and antibodies in the blood while explaining the ABO system and Rh classification system. In a lab setting with simulated blood, determine the ABO and Rh with an explanation of results written in a scientific method format. (TN Reading 2, 3, 4, 8; TN Writing 4, 6)
- 34) Outline the structure and functions of the anatomy of the cardiovascular system, paying special attention to the musculature of the walls, the chambers, and the valves of the heart and blood vessels. Locate and demonstrate the circulation of blood through the heart; describe the phases and importance of the cardiac cycle and how heart rate and cardiac output relate to one another. Listen to heart sounds, either digitally or with a stethoscope, to identify the normal and



abnormal sounds made during the cardiac cycle. Explain the causes for abnormal sounds encountered. (TN Reading 2, 3, 4, 5; TN Writing 2, 4, 9)

- 35) \*\*Differentiate among the systemic, coronary, hepatic portal, pulmonary, cerebral, and fetal circulation systems, formulating an original hypothesis on possible changes in physiology and pathology in different situations. (TN Reading 2, 8; TN Writing 8, 9)
- 36) \*\*Describe each part of the conduction system of the heart and its related function. Interpret an electrocardiograph (ECG) of a normal sinus rhythm, identifying the P, Q, R, S, and T waves with an explanation of the electrical and mechanical event of each. Identify ECG strips with explanation of sinus, junctional, and ventricular arrhythmias. (TN Reading 1, 2, 4, 9; TN Writing 4)
- 37) \*\*Develop an informational fact sheets on diseases of the cardiovascular system. Include in the fact sheet the definition of the disease, the signs and symptoms, diagnostic procedures, underlying causation, clinical manifestations, evaluation, and treatment. (TN Reading 2, 4, 6; TN Writing 4, 5)
- 38) Describe in a written, oral, or digital format the structure and function of the lymphatic system, lymphatic vessels, and lymph nodes. Differentiate between the cells of the immune response and other defenses, and explain how they work with antigens, antibodies, and individual immunity to maintain homeostasis in the body. (TN Reading 2, 4; TN Writing 4, 9)
- 39) \*\*Explain from research in peer-reviewed professional journals and/or textbooks the effects of aging on the lymphatic and immune systems, including discussion of the diseases or disorders that can occur. (TN Reading 1, 2, 8, 9; TN Writing 4, 7)
- 40) \*\* Investigate and explain, citing evidence from textbooks, professional journals, and/or websites, the mechanisms surrounding allergic response, autoimmune, and alloimmune diseases. Explain what systems are involved in the responses and any preventive measures that can be initiated. (TN Reading 1, 2, 4, 8; TN Writing 2, 4, 9)

### **Respiration, Nutrition, and Excretion**

- 41) Review case studies that involve persons with respiratory disorders, diseases, or syndromes. Citing information from the review, explain the expected anatomy involved and what abnormality is present; and outline normal and abnormal physiology, pathophysiology, preventive measures, and diagnostic procedures for identification of the disease/disorder. (TN Reading 1, 2, 6, 8, 9; TN Writing 2, 4, 9)
- 42) Define Boyle's Law and the relationship of ventilation, external respiration, internal respiration, and the overall process of gas exchange in the lungs and tissue. Correlate the neural and chemical factors in the control of inspiration and expiration. Identify normal and abnormal lung sounds, explaining the structures responsible for the sounds. (TN Reading 1, 2, 4; TN Writing 4)
- 43) Trace food from the time it enters the body until it is released, outlining the organs involved and the digestive processes that occur. (TN Reading 1, 2, 4, 5)



- 44) \*\*Compare and contrast Basal Metabolic Rate (BMR) and Basal Metabolic Index (BMI). Calculate the BMR and BMI for multiple weights and explain the significance of BMI measurement on the health of individuals. Develop a meal plan for someone who has a BMI greater than 24.5 in order to reduce risk of diabetes, heart disease, or stroke. (TN Reading 2, 4, 9; TN Writing 4, 8)
- 45) \*\*Research information to explain the pathophysiology and abnormal anatomy and/or physiology surrounding diseases, disorders, and/or syndromes of the digestive system. Explain how these abnormalities can affect one's physical health, outlining including signs and symptoms, underlying causation, clinical manifestations, diagnostic procedures, evaluation and treatment. Differentiate between the diseases in a pediatric, adult, and elderly person. Develop a public service announcement, community awareness presentation, or health education presentation to inform a selected audience about one of these diseases or disorders using the National HOSA competitive events guidelines. (TN Reading 1, 2, 4, 6, 8; TN Writing 2, 4, 6)
- 46) Design a concept map of the structures of the urinary system, complete with associated explanations of the functions of each structure. Predict possible complications for each structure and outline methods to prevent the complications. (TN Reading 2, 4; TN Writing 4, 9)
- 47) Identify the internal and external anatomy of the kidney. Analyze the blood supply that is required for functioning, the physiology of the nephrons, the process by which urine is formed, the pathways for excretion in males and females, and the chemical and nervous system control of urinary secretion. (TN Reading 2, 4, 5)
- 48) \*\*Investigate how the urinary system interacts with other body systems. Provide descriptions of the anatomy and physiology involved and possible complications that might arise with an imbalance. (TN Reading 2, 4, 5)
- 49) \*\*Research the pathophysiology and abnormal anatomy and/or physiology surrounding diseases, disorders, and/or syndromes of the urinary system. Explain how these abnormalities can affect one's physical health, outlining signs and symptoms, underlying causation, clinical manifestations, diagnostic procedures, evaluation, and treatment. Differentiate between the diseases in a pediatric, adult, and elderly person. (TN Reading 1, 7, 8, 9; TN Writing 4, 8, 9)

### **Reproduction, Growth, and Development**

- 50) Outline the structure and function of the male reproductive system. Include information about the anatomy of the spermatozoa, the ducts of the system, accessory glands, and semen. (TN Reading 1, 2, 4; TN Biology II 6)
- 51) Summarize in a written, verbal, or digital format the structure and function of the female reproductive system, and the hormones that affect the multiple stages of the menstrual cycle. (TN Reading 1, 2, 4; TN Writing 4, 6; TN Biology II 6)
- 52) Evaluate and provide evidence of the process of fertilization, mitosis, and meiosis, then outline the timeline and phases of development of a fetus, from fertilization until birth. Describe the abnormalities that can occur at each phase, including genetic disorders and other congenital complications. (TN Reading 1, 2, 4; TN Writing 4, 8; TN Biology II 4, 5, 6)



- 53) \*\*Research and develop a public service announcement or public health presentation to inform high school and young adults of the various types of sexually transmitted diseases. Provide informative and factual details concerning complications, signs and symptoms, preventive measures, and treatments available for diseases discussed. (TN Reading 1, 2, 9; TN Writing 4, 6, 9)

## Standards Alignment Notes

\*References to other standards include:

- TN Reading: [Tennessee State Standards for English Language Arts & Literacy in History/Social Studies, Science, and Technical Subjects](#); Reading Standards for Literacy in Science and Technical Subjects 6-12; Grades 11-12 Students (page 62).
  - Note: While not directly aligned to one specific standard, students who are engaging in activities outlined above should be able to also demonstrate fluency in Standard 10 at the conclusion of the course.
- TN Writing: [Tennessee State Standards for English Language Arts & Literacy in History/Social Studies, Science, and Technical Subjects](#); Writing Standards for Literacy in History/Social Studies, Science, and Technical Subjects 6-12; Grades 11-12 Students (pages 64-66).
  - Note: While not directly aligned to one specific standard, students who are engaging in activities outlined above should be able to also demonstrate fluency in Standards 3 and 10 at the conclusion of the course.
- TN Biology II: Tennessee Science: [Biology II](#) standards may provide additional insight and activities for educators.
- TN Chemistry II: Tennessee Science: [Chemistry II](#) standards may provide additional insight and activities for educators.
- TN A&P: Tennessee Science: [Anatomy and Physiology](#) standards may provide additional insight and activities for educators.
- AP Biology: Advanced Placement [Biology](#) standards may provide additional insight and activities for educators.
- P21: Partnership for 21st Century Skills [Framework for 21st Century Learning](#)
  - Note: While not all standards are specifically aligned, teachers will find the framework helpful for setting expectations for student behavior in their classroom and practicing specific career readiness skills.







## Biomedical Applications

<b>Primary Career Cluster:</b>	Health Science
<b>Consultant:</b>	Sheila Carlton, (615) 532-2839, <a href="mailto:Sheila.Carlton@tn.gov">Sheila.Carlton@tn.gov</a>
<b>Course Code(s):</b>	5992
<b>Prerequisite(s):</b>	<i>Health Science Education, Diagnostic Medicine</i>
<b>Credit:</b>	1
<b>Grade Level:</b>	11-12
<b>Graduation Requirements:</b>	This course satisfies one of three credits required for an elective focus when taken in conjunction with other Health Science courses. Satisfies one laboratory science credit in the area of life sciences.
<b>Programs of Study and Sequence:</b>	This is a capstone course option in the <i>Biotechnology Research</i> program of study.
<b>Necessary Equipment:</b>	Equipment lists can be found at <a href="http://www.tn.gov/education/cte/HealthScience.shtml">http://www.tn.gov/education/cte/HealthScience.shtml</a> .
<b>Aligned Student Organization(s):</b>	HOSA: <a href="http://www.tennesseehosa.org">http://www.tennesseehosa.org</a> Amanda Hodges, (615) 532-6270, <a href="mailto:Amanda.Hodges@tn.gov">Amanda.Hodges@tn.gov</a>
<b>Coordinating Work-Based Learning:</b>	If a teacher has completed work-based learning training, he or she can offer placement in Job Shadowing or <i>Clinical Internship</i> . For more information, please visit <a href="http://www.tn.gov/education/cte/work_based_learning.shtml">http://www.tn.gov/education/cte/work_based_learning.shtml</a> .
<b>Available Student Industry Certifications:</b>	None
<b>Dual Credit or Dual Enrollment Opportunities:</b>	There are no dual credit/dual enrollment opportunities for this course. If interested in developing, reach out to a local postsecondary institution to establish an articulation agreement.
<b>Teacher Endorsement(s):</b>	577, 015, 311, 415
<b>Required Teacher Certifications/Training:</b>	Teacher must attend 8 hours of state approved Biomedical Application training prior to teaching this course.
<b>Teacher Resources:</b>	<a href="http://www.tn.gov/education/cte/HealthScience.shtml">http://www.tn.gov/education/cte/HealthScience.shtml</a>

### Course Description

*Biomedical Applications* is a capstone course designed to prepare students to pursue careers in the fields of biotechnology research. This course combines advanced methods and technologies with the scientific principles that comprise today's emerging biomedical fields. Upon completion of this course,

proficient students will be able to identify careers in these fields, describe their scientific foundations, research technologies and development in all areas of healthcare, and relate how these technologies are transforming many disciplines and impacting society at large. In addition, students will conduct an ongoing original research project or experiment on an emerging biotechnology application of their choice. Standards in this course are aligned with Tennessee State Standards for English Language Arts & Literacy in Technical Subjects, Tennessee state standards in Biology II and Chemistry II, and Advanced Placement Biology standards.\*\*

## Program of Study Application

This is a capstone course option in the *Biotechnology Research* program of study. For more information on the benefits and requirements of implementing this program in full, please visit the Health Science website at <http://www.tn.gov/education/cte/HealthScience.shtml>.

## Course Standards

### Scientific Foundations

- 1) Differentiate between the terms biotechnology and biomedicine, noting the impact that each has had on society. Explore the history and development of these scientific fields, as well as the roles that their associated industries have played in the areas of agriculture, manufacturing, health and medicine, the environment, global society and the economy, and forensics. (TN Reading 1, 2, 9; TN Writing 4, 8, 9)
- 2) Review the structural organization of all living things at the cellular level. Summarize in an oral, written, or digital presentation how cellular organization influences scientific approaches to biotechnology and biomedicine, with specific attention given to the various levels of eukaryotic organisms, cellular molecules, proteins, and nucleic acids. (TN Reading 2, 9; TN Writing 4, 6, 8, 9; TN Biology II Standard 1; AP Biology E.U. 2.B, 2.E, 3.A)
- 3) Synthesize information from professional journals and/or websites, textbooks, and news articles to compare and contrast the structure and properties of the four macromolecules (carbohydrates, lipids, proteins, and nucleic acids). Describe in an informational artifact how the cell membrane structures may be manipulated to allow the passage of these macromolecules in a cell; relate how this knowledge is used by scientists and applied to biotechnology research. (TN Reading 1, 2, 9; TN Writing 4, 8, 9; AP Biology E.U. 2.A, 2.B)
- 4) Distinguish between a number of strategies used to isolate or clone a gene, such as activation tagging, map-based gene cloning, plasmid cloning vectors, viral vectors, and shuttle vectors. Present an overview of these strategies in a visual format. (TN Reading 2, 9; TN Writing 4, 6, 9; AP Biology E.U. 3.A, 3.C)
- 5) In an argumentative essay, state claims and counterclaims about how DNA structure and function may be exploited using modern genetic engineering methods to produce specific genetic constructs, such as selecting, excising, ligating, and cloning of genetic material. Ensure the documentation is written in domain-specific medical terminology. (TN Reading 2, 4, 9; TN Writing 1, 4, 8, 9; AP Biology E.U. 3.B)



- 6) Define the terms DNA replication, DNA transcription, and translation of mRNA. Recount the processes involved in each and describe the negative outcomes if there is an interference in the process. Using domain-specific terminology, develop a scientific explanation to support the claim that the structures and mechanisms of DNA and RNA are the primary sources of heritable information. (TN Reading 2, 9; TN Writing 9; AP Biology E.U. 3.A)
- 7) Construct a visual model, annotated with written explanations, detailing how DNA in chromosomes is transmitted to the next generation via mitosis or meiosis. Note qualitative and quantitative traits, mutations, transposable genetic elements, and regulation of gene expressions. (TN Reading 2, 4, 9; TN Writing 4, 6, 7, 9; AP Biology E.U. 3.A)
- 8) Research and explain Mendel’s model of inheritance. Using this model, trace the pattern of appearance within a family for a heritable disease that is on the recessive allele and one that is on the dominant allele. Develop an argumentative essay regarding how a certain biotechnology could genetically modify a gene to prevent this disorder, citing information from textbooks and/or professional journals and websites. (TN Reading 2, 3, 4, 9; TN Writing 1, 4, 8, 9; AP Biology E.U. 3.A, 3.B.)

### **Technologies and Development**

- 9) Investigate and develop a digital, oral, or written presentation on the current and emerging applications of biotechnology and biomedicine, such as bionic prosthesis, nanotechnology, and stem cell research. Cite textual evidence from science or professional journals, websites, and textbooks to explain how the new technologies have contributed to the advancement of diagnostics, therapeutics, genetic mapping, and disease predictions and determinants. (TN Reading 1, 2, 4, 7, 9; TN Writing 2, 4, 6, 8, 9; AP Biology E. U 3.D, 3.B.)
- 10) In an argumentative essay, provide justification for the following statement: “Humans can manipulate heritable information by at least two commonly used technologies in biomedicine” (AP Biology Essential Knowledge, learning objective 3.5). Cite information from professional peer-reviewed articles, textbooks, and/or other scientific journals to support claims. (TN Reading 1, 2, 4, 9; TN Writing 1, 4, 8, 9; AP Biology E.U. 3.A)
- 11) Investigate the ethical, social, and medical issues surrounding the research of biotechnology and biomedicine. Debate the claims and counterclaims of the issue in a written or oral format, including aspects such as protecting human subjects from harm or death, affordability of research, privacy of subjects, and the promotion of lifesaving research. (TN Reading 3, 4; TN Writing 4, 9; AP Biology 3.B)
- 12) Review the use of volume measuring devices commonly used by biotechnologists, such as pipettes, micropipettes, and glassware. Prepare solutions and appropriate media, then perform serial dilutions incorporating aseptic techniques. (TN Reading 3, 4; TN Chemistry II 3)
- 13) Explain in depth the terms and phrases often heard in a biotechnology or biomedical laboratory: quality assurance, quality control, method validation, appropriate documentation, current good manufacturing practices, and good laboratory practices. Relate how these terms and practices are important in the safe development of biomedical/biotechnology products and services. (TN Reading 3, 4; TN Writing 4, 9; TN Chemistry II 3)



## Safety

- 14) Review guidelines from governmental agencies such as the Office of Safety and Health Administration (OSHA) guidelines for medical and research laboratories, OSHA guidelines for Standard Precautions and personal protective equipment, Safety Data Sheets (MSDS) and storage of reagents and compounds, and Environmental Protection Agency (EPA) laboratory guidelines. Compare and contrast the rules and regulations of each agency to develop clear expectations regarding the maintenance of safety in these laboratories. (TN Reading 2, 4, 9; TN Writing 4, 8, 9)
- 15) Develop a safety manual for a biological or chemical laboratory, specifically for a lab that is involved with processing or developing biomedical products. Include the following in the manual: safety guidelines, procedures for accident prevention and response, and steps for reporting and documenting hazards. Explain the industry standards to maintain aseptic and sterile procedures and luminary flow, as well as the purpose of biosafety cabinets. Draw on the standard operating procedures from agencies such as OSHA, EPA, and Centers for Disease Control and Prevention (CDC) when developing the manual. (TN Reading 2, 4, 9; TN Writing 4, 5, 6, 8, 9)

## Methods and Applications

- 16) Differentiate between the terms electrophoresis, blotting, and polymerase chain reaction. Explain how each is used in DNA cloning or sequence identification, and describe the procedures involved with each. Relate how these terms and procedures apply to biotechnology. Compare and contrast the advantages and disadvantages of one method over the other. (TN Reading 2, 4, 9; TN Writing 4, 8, 9; AP Biology E.U. 3.C)
- 17) Summarize the historical background and chief purpose of the Human Genome Project. Discuss in the summary the sequence technology utilized and the method for assembly of the draft genome. Then, chart the status of the model organisms such as Arabidopsis, yeast, mouse, fruit fly, rat, nematode, Escherichia coli, and higher plant models. Report the impact that the Human Genome Project has had on medicine to date, and explain what the future holds for the project. (TN Reading 2, 4, 7, 8, 9; TN Writing 4, 8, 9; AP Biology E.U. 3.A., 3.B., 3.C)

## Perceptions and Future

- 18) Summarize research from professional journals or websites, textbooks, and/or newspaper articles surrounding an ethical issue related to biotechnology (i.e., the use of animals for lab testing, genetically modified organisms, or stem cell use). Debate the chosen topics following the modified Lincoln-Douglas format, presenting both sides of the issue. Discuss the moral, ethical, and legal responsibilities of researchers, policymakers, and other actors as they pertain to informing the public and ensuring the safety and well-being of affected populations. (TN Reading 1, 2, 4, 8, 9; TN Writing 4, 5, 8, 9; TN Biology II 1; AP Biology E.U. 3.A. 3.B)
- 19) Develop an original idea for a new biotechnology product, and simulate a situation in which the product must be pitched to a prospective client. Create an informational packet to share during the presentation that includes the following items: definition and protection of intellectual



property, type of patent, copyright issues and rules, trademarks, and breeders' rights for plants or animals. (TN Reading 2, 3, 4, 9; TN Writing 2, 4, 6, 7, 8, 9; TN Biology II 1)

- 20) Develop an argumentative essay surrounding public perceptions and attitudes toward the use of biotechnology in society. Develop claims and counterclaims thoroughly based on facts from research, pointing out the strengths and weaknesses of each claim. Document information using appropriate industry terminology, including areas such as federal and international regulation and oversight, safety assessment, labeling of products, and impact on the economy. (TN Reading 2, 4, 9; TN Writing 1, 4, 5, 8, 9; TN Biology II 1; AP Biology 3.A, 3.E)
- 21) Understand principles of and successfully perform skills related to the biomedical laboratory. Document findings from skills utilizing appropriate medical terminology. Incorporate rubrics from textbooks, National HOSA guidelines, or clinical standards of practice for the following:
- Correct use of an ultraviolet/visible spectrophotometer
  - Application of principles of electrophoresis and demonstration of skills to separate and identify DNA fragments based on size
  - Thin-layer Chromatography (TLC)
  - Isolation of DNA, establishing quantity, quality, and purity
  - Demonstration of PCR procedures
  - Conducting a qualitative enzyme-linked immunosorbent assay (ELISA)
  - Bacterial transformation
- (TN Reading 3, 4, 9; TN Writing 4, 7, 9; TN Chemistry II 1, 3; AP Biology 3.A, 3.B., 3.C., 3.E, 4.A)

### Capstone Project

- 22) Using the scientific method, design a scientific research project or experiment to investigate biotechnology applications in healthcare, industry, environment, agriculture, forensics, or related fields. Summarize the findings in an original research paper or lab report, citing evidence to support conclusions from professional journals and websites, textbooks, and original observations. In addition to the research paper, develop a Power Point, tabletop, or poster presentation to deliver before a classroom or community audience. Incorporate the following steps when carrying out the project or experiment (possible topics are listed at the end of this document):
- Research to determine the task or topic
  - Exploration of the task or topic
    - Literature review
    - Collection and evaluation of sources
  - Thesis/hypothesis proposal and annotated bibliography
  - Revision and final draft of thesis/hypothesis
  - Outline/plan of action for paper or experiment
  - Data collection/development of research ideas and narratives
  - Submission of first draft of paper/lab report
  - Feedback, revision, and submission of final draft
  - Reflection and evaluation
- (TN Reading 1, 2, 4, 6, 7, 8, 9; TN Writing 2, 4, 5, 6, 7, 8, 9; TN Chemistry II 1, 3; AP Biology 3.A, 3.B., 3.C., 3.E)



## Standards Alignment Notes

\*\*References to other standards include:

- TN Reading: [Tennessee State Standards for English Language Arts & Literacy in History/Social Studies, Science, and Technical Subjects](#); Reading Standards for Literacy in Science and Technical Subjects 6-12; Grades 11-12 Students (page 62).
  - Note: While not directly aligned to one specific standard, students that are engaging in activities outlined above should be able to also demonstrate fluency in Standard 10 at the conclusion of the course.
- TN Writing: [Tennessee State Standards for English Language Arts & Literacy in History/Social Studies, Science, and Technical Subjects](#); Writing Standards for Literacy in History/Social Studies, Science, and Technical Subjects 6-12; Grades 11-12 Students (pages 64-66).
  - Note: While not directly aligned to one specific standard, students that are engaging in activities outlined above should be able to also demonstrate fluency in Standards 3, 5, and 10 at the conclusion of the course.
- TN Biology II: Tennessee Science: [Biology II](#) standards may provide additional insight and activities for educators.
- TN Chemistry II: Tennessee Science: [Chemistry II](#) standards may provide additional insight and activities for educators.
- AP Biology: Advanced Placement [Biology](#) standards may provide additional insight and activities for educators.
- P21: Partnership for 21st Century Skills [Framework for 21st Century Learning](#)
  - Note: While not all standards are specifically aligned, teachers will find the framework helpful for setting expectations for student behavior in their classroom and practicing specific career readiness skills.

## Additional Notes

Possible topics for the capstone project include:

- 1) Biotechnology in healthcare
  - a. Diagnostic applications
  - b. Therapeutics and pharmaceuticals (gene therapy)
  - c. Bioinformatics to predict disease and determine treatment
  - d. Genetic mapping
  - e. Genetic counseling
  - f. STEM cell research and use
- 2) Industrial applications
  - a. Bioprocess
  - b. Microbial growth
  - c. Bioreactors
  - d. Water treatment
  - e. Animal pharming (i.e., the use of plants and animals to make pharmaceuticals)
- 3) Environmental applications
  - a. Bioremediation
  - b. Waste management
  - c. Phytoremediation
  - d. Biocontrol



- 4) Agriculture
  - a. Plants
  - b. GMOs
  - c. Insect resistance
  - d. Viral resistance
  - e. Herbicide resistance
  - f. Nutritional quality
- 5) Animal food biotechnology
  - a. Growth hormones
  - b. Cloning of animals
  - c. Aquaculture
  - d. Microbiology in foods
- 6) Bioterrorism/biotechnology disaster
  - a. Agent payload
  - b. Dispersal mechanisms
  - c. Biological/chemical weapons
  - d. Artificial viruses
- 7) Forensic science
  - a. DNA
  - b. Mechanisms to prevent crime
  - c. Image enhancement technologies
  - d. Data mining







TENNESSEE DEPARTMENT OF  
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## Forensic Science

<b>Primary Career Cluster:</b>	Health Science
<b>Consultant:</b>	Sheila Carlton, (615) 532-2839, <a href="mailto:Sheila.Carlton@tn.gov">Sheila.Carlton@tn.gov</a>
<b>Course Code(s):</b>	5996
<b>Prerequisite(s):</b>	Health Science Education, Diagnostic Medicine
<b>Credit:</b>	1
<b>Grade Level:</b>	11-12
<b>Graduation Requirements:</b>	This course satisfies one of three credits required for an elective focus when taken in conjunction with other Health Science courses.
<b>Programs of Study and Sequence:</b>	This is one of two capstone course options in the <i>Biotechnology Research</i> program of study.
<b>Necessary Equipment:</b>	Refer to the Teacher Resources page.
<b>Aligned Student Organization(s):</b>	HOSA: <a href="http://www.tennesseehosa.org">http://www.tennesseehosa.org</a> Amanda Hodges, (615) 532-6270, <a href="mailto:Amanda.Hodges@tn.gov">Amanda.Hodges@tn.gov</a>
<b>Coordinating Work-Based Learning:</b>	Work-Based Learning opportunities are not appropriate for this course.
<b>Available Student Industry Certifications:</b>	None
<b>Dual Credit or Dual Enrollment Opportunities:</b>	There are no dual credit/dual enrollment opportunities for this course, contact your local postsecondary institution to establish an articulation agreement.
<b>Teacher Endorsement(s):</b>	577
<b>Required Teacher Certifications/Training:</b>	Teacher must attend 8 hours state approved Forensic Science training prior to teaching this course.
<b>Teacher Resources:</b>	<a href="http://www.tn.gov/education/cte/HealthScience.shtml">http://www.tn.gov/education/cte/HealthScience.shtml</a>

### Course Description

*Forensic Science* is a capstone course designed to draw key connections throughout biology, chemistry, genetics, anatomy, and physics in a setting that supports the criminal justice system. Upon completion of this course, proficient students will have a full understanding of the scope, development, and history of forensic science, the difference between biological and chemical forensics, and how science is used in law enforcement to solve crimes. In addition, students will continue to add artifacts to the portfolio begun in *Health Science Education*, reflecting the full range of activities undertaken in their program of

study. Standards in this course are aligned with Tennessee State Standards for English Language Arts & Literacy in Technical Subjects and Tennessee State Standards in Scientific Research, Anatomy and Physiology, Biology II, and Chemistry II.\*

## Program of Study Application

This is one of the capstone courses in the *Biotechnology Research* program of study. For more information on the benefits and requirements of implementing this program in full, please visit the Health Science website at <http://www.tn.gov/education/cte/HealthScience.shtml>.

## Course Standards

### Scope and Development of Forensic Science

- 1) Define forensic science and explain the connection between science and law enforcement. Summarize the concepts of the eleven sections of forensic science as defined by the American Academy of Forensic Science. List a sample forensic science occupation that falls under each of the eleven sections. (TN Reading 2, 4, 9; TN Writing 8, 9)
- 2) Develop a career profile for at least three occupations identified from the previous standard, using print, online, and/or personal interview sources to capture at minimum the following:
  - a. Job description
  - b. Essential knowledge and skills needed for the career
  - c. Program or path of study to reach occupational goals, beginning with high school and proceeding through postsecondary
  - d. Licensure and credentialing requirements
  - e. Non-educational job requirements such as physical fitness tests, minimum age, and psychological evaluations
  - f. Role as an expert witness in courts
  - g. Specific evidence such professionals are responsible for, such as a forensic nurse assisting with gathering evidence for an alleged rape.(TN Reading 1, 7; TN Writing 4, 9)
- 3) Articulate important historical events, contributors, and development of new or changing careers influencing the evolution of forensic science in the United States. Use a timeline or other graphic to illustrate the major developments from the 16th century to today, citing specific textual evidence from textbooks, online and print journals, and other websites. Include major legislation related to the practice of forensic science. (TN Reading 1, 2, 9; TN Writing 2, 9)
- 4) Citing information found on the American Academy of Forensic Science website, news media, and legislation, describe the evolution of the modern crime laboratory. Discuss the features of present-day crime labs, including the differences between public and private labs. Explore how these features have changed expectations regarding lab services and capabilities, the new or emerging technologies they employ, or the impact on the conviction rates of criminals. (TN Reading 1, 7, 9; TN Writing 4, 8, 9)



- 5) Research the CSI media phenomenon. Summarize the information from at least three peer-reviewed articles and debate how the so-called “CSI effect” has impacted forensic science, criminal investigations, and changes in legislation. (TN Reading 2, 9; TN Writing 1)
- 6) Evaluate the principles of the scientific method and relate their application to forensic science and crime lab procedures. Complete a literature review of at least three peer-reviewed articles concerning current and emerging scientific research in forensic science. Write persuasively on the merits of the research to determine if the methodologies used meet the criteria for rigor outlined in the scientific method. (TN Reading 1, 2, 4, 5, 8; TN Writing 1, 7, 9; TN Scientific Research 2, 3, 4)
- 7) Research the history of mapping, geographic information systems (GIS), global positioning systems (GPS), remote sensing, and other geospatial technologies. Examine how these technologies have evolved in the field of forensic science, evaluating their influence on present-day society and citing specific textual evidence from textbooks, online and print journals, and other websites. Detail how a range of forensic scientists use GIS technologies in their work. (TN Reading 2, 3, 4, 9; TN Writing 8, 9)
- 8) Classify examples of forensic evidence into types such as biological, chemical, impressions, and electronic evidence. From this list, generate an explanation of the analysis methods used for physical evidence, such as chromatography, gel electrophoresis, and/or serological analysis. Focusing on one piece of evidence, determine the correct analysis method, explain what kind of information the analysis will yield, and report on how the expected outcomes will contribute to an investigation. (TN Reading 4, 8; TN Writing 7, 8, 9; TN Scientific Research 3, 4, 5)
- 9) Define chain of custody, starting at the crime scene with collection of evidence until it arrives in a lab. Predict the legal ramifications if chain of custody is not maintained when handling evidence brought to a forensic lab. Explain any special circumstances in which it is appropriate and allowable for physical evidence to be released or destroyed. (TN Reading 2, 9; TN Writing 4)

### **Biological Forensics**

- 10) Examine the differences in standard precautions, personal protective clothing, and personal protective equipment (PPE) in forensic labs as compared with other healthcare settings. Outline the steps one should take if exposure to hazardous or bloodborne pathogens occurs. Demonstrate donning and doffing all PPE and care of soiled equipment or vehicles. (TN Reading 2, 3, 4; TN Writing 9)
- 11) Differentiate between the careers of forensic anthropology and forensic odontology by reviewing case studies or viewing simulated remains in a laboratory setting. Explain the scientific processes involved in identifying remains to determine if they are human or nonhuman, and what occurs during a skeletal comparison to determine sex, ancestry, and age. Evaluate dental records or x-rays and identify normal and abnormal dental findings. Document findings from both evaluations using industry-acceptable terminology. (TN Reading 1, 2, 8; TN Writing 4; TN A&P 2)
- 12) Document a biological profile of remains. Note skin coloration, types of skeletal trauma, presence of defensive wounds or other visible marks, stage of decomposition, entomological



activity, environmental factors, rigor mortis, and post-mortem lividity. Include results that could be gathered by a forensic pathologist, forensic anthropologist, forensic radiologist, forensic dentist, coroner, or law enforcement. (TN Reading 4, 8; TN Writing 2, 4, 7, 8, 9; TN A&P 2, TN Biology II 2)

- 13) Interpret the findings of an autopsy report found from public records or online resources. Summarize the components that are typically included in an autopsy report; then relate findings to normal anatomy and physiology of the system involved. Describe the responsibilities of a medical examiner in the development of an autopsy, and report on how recent court cases have been influenced by official autopsy reports. (TN Reading 1, 2, 4; TN Writing 4, 7, 9; TN A&P 1, 2, 4)
- 14) Perform analysis on samples of hair to identify the normal morphology. Using scientific terminology and citation conventions to reference sources, explain the identification and comparison procedures used in crime labs to determine if a sample is natural human hair, manufactured hair, or animal hair. (TN Reading 3, 4; TN A&P 2)
- 15) Summarize in a graphic illustration the forensic tests performed on body fluids to determine their type. Include at least the following tests: color test, microcrystalline test, precipitin test, and gel diffusion. Explain the differences in antibodies and antigens, their relationships to blood typing, and immunoassay techniques. Perform blood typing procedures using simulated blood as well as other forensic tests as allowed by available equipment. (TN Reading 4, 9; TN Writing 4, 9; TN A&P 2, 3; TN Chemistry II 3)
- 16) Explain in a written, digital, or oral presentation basic components and concepts related to DNA. Include a definition of DNA, its chief characteristics and structure, and the features of a double helix. Compare and contrast the methods of DNA analysis, such as polymerase chain reaction (PCR), restriction fragment length polymorphisms (RFLPs), and short tandem repeats (STR). Identify the advantages and disadvantages for each, their specific uses in forensics, as well as any limitations. Practice DNA analysis in a classroom or laboratory setting. (TN Reading 1, 2, 3, 4, 7, 8; TN Writing 4, 9; TN Biology II 4, 5, 6)
- 17) Debate how DNA testing and the Combined DNA Index System (CODIS) have changed the criminal justice system, citing evidence from professional print or digital journals, case studies, court cases, or interviews with law enforcement or forensic scientists to develop claims and counterclaims. (TN Reading 1, 2, 9; TN Writing 1, 4, 9, TN Biology II 5)
- 18) Conduct a short research project to analyze fingerprint samples. Provide a synopsis of research findings to explain the following: ridge characteristics, underlying anatomy of fingerprint development, and fingerprint classes based on patterns. Explain how fingerprinting and the Automated Fingerprint Identification System (AFIS) have changed the criminal justice system, citing evidence from professional print or digital journals, case studies, court cases, or interviews with law enforcement or forensic scientists to justify claims. (TN Reading 1, 2, 4, 8, 9; TN Writing 7; TN Scientific Research 2, 3, 4, TN A&P 2)
- 19) Review case studies or case files to identify physiological and psychological factors related to criminal behavior. Relate normal anatomy and physiology with abnormal findings retrieved from literature. (TN Reading 1, 2, 7; TN Writing 7; TN Scientific Research 4; TN A&P 3)



## Chemical Forensics

- 20) Evaluate case studies or case files related to toxicological incidents. Apply analysis of these texts to explain the laboratory tests performed to identify drugs, alcohol, and other toxicology agents. Describe in lab or classroom the theories and scientific processes related to each test. Discuss the techniques that are specifically used in toxicology and what the findings of each test signify. (TN Reading 1, 2, 7; TN Writing 4, 9; TN Scientific Research 4; TN Chemistry II 3)
- 21) Identify the types of drugs that might be found in victims and/or suspects during a criminal investigation. Research and explain gas chromatography, thin-layer chromatography, mass spectrometry, ultraviolet, and infrared spectroscopy methods for identifying legal and illegal drugs. Given a case study involving drugs, select the type of laboratory analysis that would yield the appropriate information. Justify the selection with information cited from textbooks, online and print journals, and precedents identified from similar cases. (TN Reading 2, 4, 7; TN Writing 4, 5, 7; TN Chemistry II 3)
- 22) Investigate the science surrounding the physical properties of matter, and explain how they are related to the forensic analysis of glass, fibers, metals, and/or paints. Apply the principles of temperature, weight and mass, density, and the refractive index in the context of forensic science. (TN Reading 2, 3, 4; TN Writing 4; TN Scientific Research 3; TN Chemistry II 2)
- 23) Explain the scientific basis for identifying the presence of gunpowder residue on objects, victims, and suspects; similarly, explain how scientists identify impressions on the victim or those who have left a crime scene. Include in the explanation how to determine bullet caliber from a wound in a victim. Review cases that have been decided based on impressions and ballistic evidence, and relate how forensic science was involved. (TN Reading 2, 3, 4, 8; TN Writing 2, 7, 8, 9; TN Scientific Research 2, 3, 4, 5; TN Chemistry II 3)

## Portfolio

- 24) Update the portfolio started in *Health Science Education* to demonstrate mastery of skills and knowledge acquired throughout the full Biotechnology Research program of study and applied in the final course. The portfolio should reflect thoughtful assessment and evaluation of the progression of work, exhibiting personal and professional growth in the health science pathway. The following artifacts will reside in the student portfolio:
- Career Exploration portfolio
  - Skills performance rubrics
  - Documentation of job shadowing hours
  - Examples of written, oral, or digital presentations
  - Short research project documents
- (TN Writing 4, 5)



## Standards Alignment Notes

\*References to other standards include:

- TN Reading: [Tennessee State Standards for English Language Arts & Literacy in History/Social Studies, Science, and Technical Subjects](#); Reading Standards for Literacy in Science and Technical Subjects 6-12; Grades 11-12 Students (page 62).
  - Note: While not directly aligned to one specific standard, students who are engaging in activities outlined above should be able to also demonstrate fluency in Standard 10 at the conclusion of the course.
- TN Writing: [Tennessee State Standards for English Language Arts & Literacy in History/Social Studies, Science, and Technical Subjects](#); Writing Standards for Literacy in History/Social Studies, Science, and Technical Subjects 6-12; Grades 11-12 Students (pages 64-66).
  - Note: While not directly aligned to one specific standard, students who are engaging in activities outlined above should be able to also demonstrate fluency in Standards 3 and 10 at the conclusion of the course.
- TN Scientific Research: Tennessee Science: [Scientific Research](#) standards 2, 3, 4, and 5 may provide additional insight and activities for educators.
- TN A&P: Tennessee Science: [Anatomy and Physiology](#) standards 1, 2, 3, and 4 may provide additional insight and activities for educators.
- TN Biology II: Tennessee Science: [Biology II](#) standards 2, 4, and 5 may provide additional insight and activities for educators.
- TN Chemistry II: Tennessee Science: [Chemistry II](#) standards 2 and 3 may provide additional insight and activities for educators.
- P21: Partnership for 21st Century Skills [Framework for 21st Century Learning](#)
  - Note: While not all standards are specifically aligned, teachers will find the framework helpful for setting expectations for student behavior in their classroom and practicing specific career readiness skills.





## Medical Terminology

<b>Primary Career Cluster:</b>	Health Science
<b>Consultant:</b>	Sheila Carlton, (615) 532-2839, <a href="mailto:Sheila.Carlton@tn.gov">Sheila.Carlton@tn.gov</a>
<b>Course Code(s):</b>	5883
<b>Prerequisite(s):</b>	None
<b>Credit:</b>	1
<b>Grade Level:</b>	11-12
<b>Graduation Requirements:</b>	This course satisfies one of three credits required for an elective focus when taken in conjunction with other Health Science courses.
<b>Programs of Study and Sequence:</b>	This course can be taken in the <i>Diagnostic Services, Health Informatics, Emergency Services, or Therapeutic Clinical Services</i> .
<b>Necessary Equipment:</b>	Refer to the Teacher Resources page.
<b>Aligned Student Organization(s):</b>	HOSA: <a href="http://www.tennesseehosa.org">http://www.tennesseehosa.org</a> Amanda Hodges, (615) 532-6270, <a href="mailto:Amanda.Hodges@tn.gov">Amanda.Hodges@tn.gov</a>
<b>Coordinating Work-Based Learning:</b>	Not applicable; content covered in this course is included in all Health Science WBL experiences.
<b>Available Student Industry Certifications:</b>	None
<b>Dual Credit or Dual Enrollment Opportunities:</b>	There are dual credit/dual enrollment opportunities for this course. Contact a local postsecondary institution to establish an articulation agreement.
<b>Teacher Endorsement(s):</b>	577
<b>Required Teacher Certifications/Training:</b>	None
<b>Teacher Resources:</b>	<a href="http://www.tn.gov/education/cte/HealthScience.shtml">http://www.tn.gov/education/cte/HealthScience.shtml</a>

### Course Description

*Medical Terminology* is a course designed to provide students with the opportunity to develop working knowledge of the language of healthcare professionals. Students will acquire vocabulary-building and problem-solving skills by learning prefixes, suffixes, roots, combining forms, and abbreviations commonly used in medical fields. Utilizing a body systems approach, students will define, interpret, and pronounce medical terms relating to structure and function, pathology, diagnosis, clinical procedures, and pharmacology. Upon completion of this course, students proficient in *Medical Terminology* will be



able to apply problem-solving skills to the documentation of medical phenomena and will be able to communicate fluently in the language of medicine when working in healthcare settings. Standards in this course are aligned with Tennessee State Standards for English Language Arts & Literacy in Technical Subjects and Tennessee Anatomy and Physiology standards.\*

## Program of Study Application

This course appears in the *Diagnostic Services*, *Health Informatics*, *Emergency Services*, and *Therapeutic Clinical Services* programs of study. For more information on the benefits and requirements of implementing these programs in full, please visit the Health Science website at <http://www.tn.gov/education/cte/HealthScience.shtml>.

## Course Standards

- 1) Interpret the historical development of the medical language, illustrating the Latin and Greek origination of the medical terms used today. In an informational artifact, detail the importance of historical events in medicine and their relationship to modern medical language.\*\* (TN Reading 1, 2, 4; TN Writing 2, 8)
- 2) Identify and explain the definitions and roles of the four types of word parts (word roots, combining forms, combining vowels, suffixes, and prefixes) in forming medical terms. Apply knowledge of word forms and structures to interpret unfamiliar medical terms throughout this course. Research the origins of eponyms; then differentiate between medical eponyms, acronyms, and abbreviations. (TN Reading 1, 4, 9; TN Writing 8, 9)
- 3) Research and summarize the precautions surrounding the use of abbreviations and symbols within the healthcare profession. Explain and demonstrate the importance of clear, proper documentation when filling out a patient/client chart or other patient document. For example, explain why using appropriate abbreviations is so important when prescribing the correct dosage for a patient's medication (i.e., writing "mg" for milligrams). (TN Reading 1, 2, 4, 5, 6, 9; TN Writing 2, 4, 8)
- 4) Examine a professional medical journal or mock patient document specifically related to an unfamiliar disease, phenomenon, diagnosis, or area of medical research. Demonstrate the ability to locate medical terms and define the prefixes, suffixes, abbreviations, and symbols in order to arrive at a professional understanding of the topic discussed. Interpret and synthesize the text into an original summary, review, or other written or verbal analysis of the topic, showing mastery of unfamiliar terms. (TN Reading 1, 2, 4, 5, 6; TN Writing 4, 8, 9)
- 5) Evaluate multiple evidenced-based research articles. Document in an informational artifact the correlation of diseases and/or disorders discussed in the articles with terminology associated with anatomical positions, body planes, cavities, directional terms, body systems, and symbols. (TN Reading 2, 4, 9; TN Writing 7, 8, 9)
- 6) Analyze and interpret vocabulary related to pathology, diagnostic, and therapeutic medical terms, as well as abbreviations of the body systems below, by evaluating professional texts featuring such terms. Demonstrate mastery of medical terminology use and accurate spelling in each area through verbal and written explanation.



- a. Cells, tissues, and glands
  - b. Genetics
  - c. Integumentary
  - d. Respiratory
  - e. Cardiovascular
  - f. Musculoskeletal
  - g. Endocrine
  - h. Nervous
  - i. Lymphatic/immune and hemolytic
  - j. Gastrointestinal
  - k. Urinary
  - l. Special senses
  - m. Reproductive
- (TN Reading 1, 2, 4, 6, 7, 9; TN Writing 2, 4, 8, 9; TN A&P 2, 3, 4, 5, 6)
- 7) Interpret, analyze, and accurately spell vocabulary linked to diagnostic procedures and pharmacology in the following areas: therapeutic services, diagnostic medicine, biotechnology services, emergency medical services, cardiovascular services, and dental services. Demonstrate the skills involved when interpreting a prescription or complex diagnostic procedure by explaining the terminology, abbreviations, and symbols to a classmate in language that is more familiar and easy to understand. (TN Reading 2, 4, 6, 7, 9; TN Writing 2, 4, 8, 9)
- 8) Research a current medical, legal, or ethical issue found within professional and/or peer reviewed journals. Develop an informative or persuasive article, report, or research paper documenting the concepts and perspectives surrounding the issue. When writing, include appropriate medical terminology and apply conventional citation methods used in medical literature. For example, investigate current debates surrounding stem cell research and argue for whether this line of research benefits the medical community and society at large; or, document the increase in mental health diagnoses and the impact this phenomenon has on the population. Cite all sources used in the course of the research. (TN Reading 1, 2, 4, 6, 7, 9; TN Writing 1, 2, 4, 6, 8, 9)

## Standards Alignment Notes

\*References to other standards include:

- TN Reading: [Tennessee State Standards for English Language Arts & Literacy in History/Social Studies, Science, and Technical Subjects](#); Reading Standards for Literacy in Science and Technical Subjects 6-12; Grades 11-12 Students (page 62).
  - Note: While not directly aligned to one specific standard, students who are engaging in activities outlined above should be able to also demonstrate fluency in Standard 10 at the conclusion of the course.
- TN Writing: [Tennessee State Standards for English Language Arts & Literacy in History/Social Studies, Science, and Technical Subjects](#); Writing Standards for Literacy in History/Social Studies, Science, and Technical Subjects 6-12; Grades 11-12 Students (pages 64-66).



- Note: While not directly aligned to one specific standard, students who are engaging in activities outlined above should be able to also demonstrate fluency in Standards 5 and 10 at the conclusion of the course.
- TN A&P: Tennessee Science: Anatomy and Physiology
- P21: Partnership for 21st Century Skills [Framework for 21st Century Learning](#)
  - Note: While not all standards are specifically aligned, teachers will find the framework helpful for setting expectations for student behavior in their classroom and practicing specific career readiness skills.

### **Additional Notes**

\*\*Informational artifacts include but are not limited to brochures, posters, fact sheets, narratives, essays, and presentations. Graphic illustrations include but are not limited to charts, rubrics, drawings, and mode





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## Nursing Education

<b>Primary Career Cluster:</b>	Nursing Education
<b>Consultant:</b>	Sheila Carlton, (615) 532-2839, <a href="mailto:Sheila.Carlton@tn.gov">Sheila.Carlton@tn.gov</a>
<b>Course Code(s):</b>	6000
<b>Prerequisite(s):</b>	<i>Medical Therapeutics, Anatomy &amp; Physiology</i> (Pre- or co-requisite)
<b>Credit:</b>	1
<b>Grade Level:</b>	11-12
<b>Graduation Requirements:</b>	This course satisfies one of three credits required for an elective focus when taken in conjunction with other Health Science courses.
<b>Programs of Study and Sequence:</b>	This is the final course in <i>Therapeutic Nursing Services</i> program of study.
<b>Necessary Equipment:</b>	Refer to the Teacher Resources page.
<b>Aligned Student Organization(s):</b>	HOSA: <a href="http://www.tennesseehosa.org">http://www.tennesseehosa.org</a> Amanda Hodges, (615) 532-6270, <a href="mailto:Amanda.Hodges@tn.gov">Amanda.Hodges@tn.gov</a>
<b>Coordinating Work-Based Learning:</b>	Students enrolled in this course who wish to pursue certification must spend a minimum of 40 hours in a clinical setting. Twenty-four of the 40 hours must be spent in a long-term care facility, and the remainder can take place in any setting that employs certified nursing assistants. For teacher requirements to participate in work-based learning, please visit <a href="http://www.tn.gov/education/cte/work_based_learning.shtml">http://www.tn.gov/education/cte/work_based_learning.shtml</a> .
<b>Available Student Industry Certifications:</b>	Certified Nursing Assistant
<b>Dual Credit or Dual Enrollment Opportunities:</b>	There are no known dual credit/dual enrollment opportunities for this course. If interested in developing, reach out to a local postsecondary institution to establish an articulation agreement.
<b>Teacher Endorsement(s):</b>	577 Registered Nurse with one-year long-term care (LTC) experience and two years' experience supervising certified nursing assistants if seeking student certification. In lieu of LTC experience, teacher can have local LTC RN serve as program coordinator.
<b>Required Teacher Certifications/Training:</b>	Attend 8 hours of state approved Nursing Education training and obtain a Train the Trainer certificate to meet federal code section 483.152. Teachers who have never taught Clinical Internship MUST attend an 8 hour training provided by Department of Education and must also attend work-based learning training.
<b>Teacher Resources:</b>	<a href="http://www.tn.gov/education/cte/HealthScience.shtml">http://www.tn.gov/education/cte/HealthScience.shtml</a>

## Course Description

*Nursing Education* is a capstone course designed to prepare students to pursue careers in the field of nursing. Upon completion of this course, a student proficient in *Nursing Education* will be able to implement communication and interpersonal skills, maintain residents' rights and independence, provide care safely, prevent emergency situations, prevent infection through infection control, and perform the skills required of a nursing assistant. At the conclusion of this course, if students have logged 40 hours of classroom instruction and 20 hours of classroom clinical instruction, and if they have completed 40 hours of site-based clinical with at least 24 of those hours spent in a long-term care facility, then they are eligible to take the certification examination as a Certified Nursing Assistant (CNA). Prior to beginning work at a clinical site, students must be certified in Basic Life Support (BLS) Cardiopulmonary Resuscitation (CPR), and deemed competent in basic first aid, body mechanics, Standard Precaution guidelines, and confidentiality. Standards in this course are aligned with Tennessee State Standards in English Language Arts & Literacy in Technical Subjects, Tennessee State Standards for Anatomy & Physiology, and Tennessee Nursing Education Training Program requirements.\*

*Note:* In order for students to qualify for the nursing assistant certification examination, the training program must be approved at least 30 days before the first day of class by the Tennessee Department of Health Nurse Aide Training program staff.

## Program of Study Application

This is the capstone course in the *Therapeutic Nursing Services* program of study. For more information on the benefits and requirements of implementing this program in full, please visit the Health Science website at <http://www.tn.gov/education/cte/HealthScience.shtml>.

## Course Standards

### Professionalism, Residents' Rights, and Independence

- 1) Differentiate between the services and careers in a long-term care (LTC) setting. Document allowable length of stay, payment options, and regulation of LTC facilities in written, oral, and digital artifacts. Research and document educational requirements as well as state and national guidelines governing practicing professionals (such as licensing, certifications, training, and compliance) in a long-term care (LTC) setting. (TN Reading 2; Writing 2, 7, 8, 9)
- 2) Identify personal and professional characteristics of an employee in an LTC facility. Explain the characteristics in the context of the nursing assistant's role and relate them to common professionalism expectations, including expectations surrounding attire, chain of command, scope of practice, resident care plan, nursing process, time management, and assignments. (TN Reading 2, 4; TN Writing 9)
- 3) Obtain a copy of an LTC facility residents' right document. Analyze the document and discuss in a written, oral, or digital artifact\*\* the importance of maintaining a healthy, safe, and respectful environment that includes families and friends. Address at minimum the following components: residents' environment and quality of life; obligation of staff to inform resident and their families of rights and services; right to participate in own care; right to independent choice; informed consent; right to privacy and confidentiality; maintaining care and security of



residents' personal possessions; and avenues for dealing with disputes and/or grievances. (TN Reading 1, 2, 5; TN Writing 2, 4, 6, 8, 9)

- 4) Interpret the Omnibus Reconciliation Act (OBRA) and explain the key concepts in an informational artifact that can be used when teaching new residents and/or their families. Key concepts can include, but are not limited to:
  - a. Importance of an individualized plan of care for each resident
  - b. Minimal requirements for nursing assistant training
  - c. Long Term Care Minimum Data Sets guidelines
  - d. Roles of Ombudsmen
  - e. Explanation of Long-Term Care Minimum Data Set (MDS)
  - f. Purpose and importance of Patient Self-Determination Act(TN Reading 1, 2, 4; TN Writing 2, 4, 8, 9)
- 5) Summarize the Health Insurance Portability and Accountability Act (HIPAA). Create a digital or written artifact that differentiates between the characteristics and rights of residents pertaining to advanced directives, living wills, durable power of attorney, and other legal directives governing medical treatment in a long-term care setting. Explain, using domain-specific language and accurate definitions of legal concepts, how the content of these legal documents influences residents' rights in a long-term care facility for all aspects of care. (TN Reading 1, 2, 4, 5; TN Writing 4, 6, 8, 9)
- 6) Define the terms *abuse* and *neglect*, and differentiate among various types of abuse and neglect through an evaluation of scenarios. Document findings from the scenarios using an electronic or paper template approved by the instructor. Include all suspicious findings and actual signs of abuse and/or neglect. Provide a verbal report to the instructor detailing the findings, citing evidence from documentation. (TN Reading 4, 7; TN Writing 4, 6, 8, 9)
- 7) Review LTC facility policy and procedures pertaining to use of physical and mental restraints of residents. Drawing on evidence from health journals and patient rights advocacy organizations, develop an informational artifact discussing the types of restraints, reasons for their uses, restraint alternatives, any associated physical and psychological problems, and residents' rights associated with restraints. The artifact should be assembled in a print or digital format that could be shared with a resident, his/her family, and/or co-workers, citing specific textual evidence and incorporating evidenced-based practice. (TN Reading 1, 4, TN Writing 5, 6, 8, 9)

### **Communication/Cultural Diversity**

- 8) Examine the skills needed to effectively and respectfully communicate with an LTC resident. Discuss such facets as verbal and nonverbal communication, how to respond to residents' negative or changing behaviors, cultural diversity, residents with special needs or cognitive impairments, barriers to communication, and integration of assistant's interpersonal skills. Practice communication skills in a classroom clinical and LTC setting with classmates, families, geriatrics, and persons with special needs, obtaining objective and subjective patient information. (TN Reading 2, 3, 4, 9; TN Writing 8, 9)
- 9) Research guidelines and formats pertaining to nursing assistant documentation in an LTC facility. Interpret domain-specific words and phrases that are used in documentation, especially in



regards to legal requirements and correct medical terminology. Role-play giving and receiving a resident status report using the documented information. (TN Reading 3, 4, 9; TN Writing 4, 5, 6)

### **Infection Control/Medical Microbiology**

- 10) Review infection control guidelines, Standard Precaution guidelines, Transmission-Based precautions, Personal Protective Equipment use, and infection control of elderly in an LTC facility. Practice skills related to hand washing, donning and doffing a gown, masks, gloves and goggles, handling and cleaning spills, cleaning equipment, and handling laundry. (TN Reading 1, 2, 3, 4)
- 11) Infections are prevalent in LTC facilities. In a written or digital format, synthesize information from a range of sources, such as the Centers for Disease Control, into a coherent understanding of the signs/symptoms (s/sx), causative agents, and precautions and preventive measures for the following infectious diseases frequently encountered in an LTC:
  - a. Tuberculosis
  - b. Hepatitis
  - c. Methicillin-resistant Staphylococcus aureus (MRSA)
  - d. Vancomycin-Resistant enterococcus (VRE)
  - e. Clostridium difficile or C. diff
  - f. Nosocomial infections(TN Reading 1, 2, 7, 9; TN Writing 2, 8, 9)

### **Safety/Emergency Care**

- 12) Develop a health education presentation, public service announcement, or brochure for healthcare professionals in an LTC facility aimed at identifying persons at greatest risk for accidents. Include at least the following: types of risk, how to identify risk, signs and symptoms of physical complications of risk, guidelines for preventing risk, and residents' rights. Include at least three resources. (TN Reading 1, 3, 5; TN Writing 2, 4, 7, 9)
- 13) Investigate the principles of proper body mechanics for the LTC staff members and for the residents. Document industry-specific guidelines for assisting the resident and/or family member to group and other activities safely. Apply the principles in a classroom clinical setting in order to prevent injury and utilize less energy. (TN Reading 1, 3, 9; TN Writing 9)
- 14) Outline potential medical emergencies within an LTC facility, especially those related to fire, oxygen, choking, wandering or sundowner's syndrome, shock, Myocardial Infarction (MI), bleeding, burns, fainting, diabetes, Cardiovascular Accident (CVA), and natural disasters. Generate a plan and/or guidelines of care for each of the areas previously listed, incorporating facility policies, national standards, and any other resource necessary. (TN Reading 2, 3, 7, 9; TN Writing 2, 6, 8, 9)

### **Basic Nursing Skills**

- 15) Outline the normal structure and function of body systems related specifically to geriatric clientele, and summarize appropriate medical text(s) in order to list signs and symptoms of common diseases and disorders associated with each. Compile a paper or digital artifact





describing abnormalities in geriatric patients and what should be reported to a nurse and/or physician for the following:

- a. Integumentary systems
- b. Nervous system with eye and ears
- c. Musculoskeletal systems
- d. Cardiovascular and respiratory systems
- e. Digestive and urinary systems
- f. Endocrine systems

(TN Reading 2; TN A&P 2, 3, 4, 5, 6)

- 16) Assess vital signs to determine oral temperature, radial and apical pulse, respirations, blood pressure, height, and weight. Calculate body mass index (BMI). Identify acceptable ranges for adult and geriatric patients, as well as the measurements that must be reported to the nurse, including possible causes. Document assessment finding on a classmate or resident's chart at least ten times during the semester. (TN Reading 2, 3, 8; TN Writing 9)
- 17) In a role-play scenario, articulate nursing assistant standards for the care of a resident who is receiving oxygen therapy. Be able to discuss the reasons for oxygen therapy, types of therapy, types of devices, and safety precautions. Document the process using clear, concise writing skills and domain-specific medical terminology. (TN Reading 3, 8; TN Writing 5, 9)
- 18) Conduct a short research project to evaluate the causes and management of physical pain in LTC and geriatric residents. Synthesize the information from multiple authoritative sources in a written, creative, or digital presentation (such as a science fair presentation or an art therapy presentation). (TN Reading 3, 8, 9; TN Writing 2, 4, 7, 8, 9)

### Personal Care Skills

- 19) Understand principles of and successfully perform skills related to personal care. Incorporate guidelines for residents' rights and utilize rubrics from textbooks, National HOSA guidelines, or other clinical standards of practice for the following:
  - a. Principles of self-care versus full care
  - b. Bathing/skin care/back rub
  - c. Grooming/shaving/hair care/nail care
  - d. Mouth care/denture care of conscious and comatose resident
  - e. Dressing
  - f. Transfers, positioning, turning in bed
  - g. Bed making, occupied and unoccupied
  - h. Care for resident when death is imminent

(TN Reading 3, 6)

- 20) Understand principles of and successfully perform skills related to toileting, intake and output, and bedpan or bedside commode use. Incorporate guidelines for residents' rights and utilize rubrics from textbooks, National HOSA guidelines, or other clinical standards of practice for the following:
  - a. Urine characteristics, and abnormalities that should be reported to the charge nurse
  - b. Common disorders of bladder and bowels
  - c. Factors affecting elimination of urine or stool



- d. Types of urine specimens obtained
- e. Catheter care/emptying urinary bag
- f. Procedure for collecting urine and stool specimens
- g. Care guidelines for ostomy

(TN Reading 3, 6)

21) Understand principles of and successfully perform skills related to proper feeding techniques to assist with eating and hydration. Incorporate guidelines of residents' rights and utilize rubrics from textbooks, National HOSA guidelines, or other clinical standards of practice for the following:

- a. Nutritional needs of the elderly
- b. Factors that influence food preference
- c. Special diets
- d. Thickened liquids
- e. Swallowing issues and dysphagia
- f. Heimlich per American Heart Association or American Red Cross standards

(TN Reading 3, 6)

22) Understand principles of and successfully perform skills related to basic restorative care. Incorporate guidelines of residents' rights and utilize rubrics from textbooks, National HOSA guidelines, or other clinical standards of practice for the following:

- a. Promoting self-care
- b. Range of Motion (ROM) exercises and maintenance
- c. Ambulation with and without assistive devices
- d. Use of assistive devices in transferring, eating, and dressing
- e. Care and use of prosthetic/orthotic devices
- f. Role of physical therapy, occupational therapy, and speech therapy in LTC and assisted living facilities

(TN Reading 3, 6)

### **Mental Health, Social Needs, and Care of the Cognitively Impaired**

23) Investigate mental health diseases in the elderly and compare their challenges to those faced by middle adults in Erikson's psychosocial developmental stage. Use technology to produce a health education plan, public service announcement, or a public health presentation intended to inform the public about signs and symptoms, incidence, how the disease/disorder affects the resident and/or family, how to modify staff behavior in response to residents' behavior, and possible treatments. (TN Reading 1, 2, 7, 9; TN Writing 6, 8, 9)

24) Drawing evidence from professional journals and other evidence-based medical websites, analyze the normal changes that occur in the aging of the elderly brain. Include in the analysis: (a) developmental task of aging, (b) methods to reduce the effects of cognitive impairment, (c) attitudes of staff caring for cognitively impaired residents, (d) communication with cognitively impaired residents, (e) methods to reduce effects of cognitive impairment, and (f) acceptable interventions associated with cognitive disorders and behaviors. Present the information in individual or group work using digital and written formats. (TN Reading 1, 2, 9; TN Writing 2, 4, 6, 8, 9)



- 25) Examine a range of ethical dilemmas encountered in an LTC facility. For example, compare and contrast the legal rights of residents to make their own personal choices with instances in which family involvement may be necessary in order to care and make decisions for patients who have cognitive disorders. Craft an original argument outlining the circumstances under which a certain behavior or medical decision would be ethically or legally justified, citing examples and medical evidence to support claims. (TN Reading 1, 2, 9; TN Writing 1, 4, 8, 9)
- 26) Describe therapies or strategies for addressing the unique needs of cognitively impaired residents and modifying behavior in a positive manner. Identify any resources or support groups available in the local community for resident and families. Reach out to those resources and/or groups to obtain information; then develop a written or digital teaching plan for residents and families. (TN Reading 1, 2, 9; TN Writing 2, 4, 6, 8, 9)

### Portfolio

- 27) Compile and continually update a portfolio of artifacts completed in this course. If pursuing Nursing Assistant certification or dual enrollment/dual credit hours, document hours spent on activities such as clinical placement or classroom contact with an articulated institution. Upon completion of the course, prepare the portfolio in a professional style to present to an appropriate nursing audience. The following artifacts will reside in the student portfolio:
- Skills performance rubrics
  - Documentation of long-term clinical hours
  - Documentation of classroom clinical hours
  - Examples of written, oral, or digital presentations
  - Job applications
  - Resumes
  - Mock or actual Job Interviews
- (TN Reading 3; TN Writing 5, 9)

### Standards Alignment Notes

\*References to other standards include:

- TN Reading: [Tennessee State Standards for English Language Arts & Literacy in History/Social Studies, Science, and Technical Subjects](#); Reading Standards for Literacy in Science and Technical Subjects 6-12; Grades 11-12 Students (page 62).
  - Note: While not directly aligned to one specific standard, students who are engaging in activities outlined above should be able to also demonstrate fluency in Standard 10 at the conclusion of the course.
- TN Writing: [Tennessee State Standards for English Language Arts & Literacy in History/Social Studies, Science, and Technical Subjects](#); Writing Standards for Literacy in History/Social Studies, Science, and Technical Subjects 6-12; Grades 11-12 Students (pages 64-66).
  - Note: While not directly aligned to one specific standard, students who are engaging in activities outlined above should be able to also demonstrate fluency in Standards 3, 5, and 10 at the conclusion of the course.
- TN A&P: Tennessee Department of Education Curriculum Standards, Secondary 9-12 Science, [Human Anatomy and Physiology](#).
- P21: Partnership for 21st Century Skills [Framework for 21st Century Learning](#)



- Note: While not all standards are specifically aligned, teachers will find the framework helpful for setting expectations for student behavior in their classroom and practicing specific career readiness skills.
- Nurse Aide Training Program requirements for Tennessee
  - These are the [minimum requirements](#) that all programs must include in order for students to be eligible to take the competency evaluation to become a Certified Nursing Assistant.

### **Additional Notes**

\*\*Artifacts can include, but are not limited to, brochures, posters, fact sheets, narratives, essays, and presentations. Graphic illustrations can include, but are not limited to, charts, rubrics, drawings, and models.





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## Emergency Medical Services

<b>Primary Career Cluster:</b>	Health Science
<b>Consultant:</b>	Sheila Carlton, (615) 532-2839, <a href="mailto:Sheila.Carlton@tn.gov">Sheila.Carlton@tn.gov</a>
<b>Course Code(s):</b>	5995
<b>Prerequisite(s):</b>	<i>Health Science Education (5998) and Emergency Preparedness (6151) for the Emergency Services POS. Principles of Fire and Emergency Services (6154), Emergency Preparedness (6151) and Fire Science I (6152) for the Fire Management Services POS.</i>
<b>Credit:</b>	1
<b>Grade Level:</b>	11-12
<b>Graduation Requirements:</b>	This course satisfies one of three credits required for an elective focus when taken in conjunction with other Health Science courses.
<b>Programs of Study and Sequence:</b>	This is the final course in <i>Emergency Services</i> and <i>Fire Management Services</i> programs of study.
<b>Necessary Equipment:</b>	Equipment lists can be found at <a href="http://www.tn.gov/education/cte/HealthScience.shtml">http://www.tn.gov/education/cte/HealthScience.shtml</a> .
<b>Aligned Student Organization(s):</b>	HOSA: <a href="http://www.tennesseehosa.org">http://www.tennesseehosa.org</a> Amanda Hodges, (615) 532-6270, <a href="mailto:Amanda.Hodges@tn.gov">Amanda.Hodges@tn.gov</a>
<b>Coordinating Work-Based Learning:</b>	If a teacher has completed work-based learning training, he or she can offer placement in Job Shadowing or <i>Clinical Internship</i> . For more information, please visit <a href="http://www.tn.gov/education/cte/work_based_learning.shtml">http://www.tn.gov/education/cte/work_based_learning.shtml</a> .
<b>Available Student Industry Certifications:</b>	Emergency Medical Responder (EMR), if teacher is an authorized EMS Instructor at the EMR level for EMR 60 hours of instruction; if not authorized, then the program must have an authorized instructor to coordinate with the local office of EMS and provide required training.*
<b>Dual Credit or Dual Enrollment Opportunities:</b>	There are dual credit/dual enrollment opportunities available for this course. Reach out to a local postsecondary institution to establish an articulation agreement.
<b>Teacher Endorsement(s):</b>	577 Registered Nurse or other professional with pre-hospital or emergency experience if teaching for certification.
<b>Required Teacher Certifications/Training:</b>	If teachers are teaching this course as First Responder certification, then they must have 8 hours of training provided by Department of Education.
<b>Teacher Resources:</b>	<a href="http://www.tn.gov/education/cte/HealthScience.shtml">http://www.tn.gov/education/cte/HealthScience.shtml</a>

\*[National Emergency Medical Services Educational Standards](#) should be incorporated into instruction.

## Course Description

*Emergency Medical Services* is a capstone course designed to prepare students to pursue careers in the fields of emergency medicine. Upon completion of this course, a student proficient in *Emergency Medical Services* will be able to: identify careers and features of the EMS system; define the importance of workforce safety and wellness; maintain legal and ethical guidelines; correlate anatomy and physiology concepts to the patient with a medical or traumatic injury; and perform EMS skills with a high level of proficiency. If taught with an EMT instructor, students will be given the opportunity to sit for the National Emergency Medical Responder certification. Standards in this course are aligned with National Highway Traffic Safety Administration, National Emergency Medical Services Education Standards, and Tennessee State Standards in English Language Arts & Literacy in Technical Subjects.\*\* Each standard presumes that the expected knowledge and behaviors are within the scope of practice for that EMS licensure level, as defined by the National EMS Scope of Practice Model. Each competency applies to patients of all ages, unless a specific age group is identified. The standards also presume there is a progression in practice from the Emergency Medical Responder level to the Paramedic level. The descriptors used to illustrate the increasing complexity of knowledge and behaviors through the progression of licensure levels originate, in part, from the National EMS Scope of Practice Model.

*Note: If this course is taught for EMR certification, the program must be approved by TN Department of Health, Office of Emergency Medical Services. **Students enrolled in this course must be 17 years old before the course ends.***

## Program of Study Application

This is the capstone course in the *Emergency Services* and the *Fire Management Services* programs of study. For more information on the benefits and requirements of implementing these programs in full, please visit the Health Science website at <http://www.tn.gov/education/cte/HealthScience.shtml> or the Law, Public Safety, Corrections and Security website at <http://www.tn.gov/education/cte/LawPublicSafetyCorrectionsSecurity.shtml>.

## Course Standards

### EMS Systems and Operations

- 1) Compare and contrast the types of Emergency Medical Services (EMS) systems and operations, including ground, water, and air services. For each type of service, discuss how the public accesses EMS systems, the advantages and disadvantages, special considerations, and safety issues. Discuss the roles played by the state departments of EMS and the National Highway Traffic Safety Administration. (TN Reading 2, 4, 9; TN Writing 8; EMR-P, EMR-EM)
- 2) Research the history of mapping, geographic information systems (GIS), global positioning systems (GPS), remote sensing, and other geospatial technologies. Examine how these technologies have evolved in the area of EMS, concentrating on their recent migration towards online platforms, and evaluate their influence on present-day society, citing specific textual evidence from news articles and scholarly journals. (TN Reading 1, 2; TN Writing 2)
- 3) Differentiate between the careers in various types of EMS. Research and document educational requirements as well as state and national guidelines governing practicing professionals (such as



licensing, initial certifications, re-certifications, training, and compliance). Identify personal and physical characteristics required of an EMS professional in a career portfolio. (TN Reading 1, 2, 9; TN Writing 2, 7, 8, 9; EMR-P)

- 4) Using texts from EMS professional journals or websites, evaluate concepts of quality improvement to provide safe, high quality, and appropriate patient care and the impact of research on EMR care. Cite examples of research that have been incorporated into improving emergency care for patients and/or victims of accidents/injuries. (TN Reading 1, 2, 7, 9; TN Writing 2, 4, 8, 9; EMR-P, EMR-MT)
- 5) Outline the risks and responsibilities facing the emergency response team during ambulance operations. Address at minimum the following: apparatus and equipment readiness; pre-arrival considerations, especially for high-risk situations; scene safety of personnel and patient(s); traffic; 360 degree assessments; and how to leave a scene. (TN Reading 2, 3, 9; TN Writing 9; EMR-EM )
- 6) Review guidelines from the *Emergency Preparedness* course related to National Incident Management System (NIMS) compliance (at minimum, IS-700, IS-800, ICS-100), and provide support for the inclusion of such concepts in the EMS system. Develop a plan for handling multiple casualty incidents, including hazardous waste, Simple Triage and Rapid Treatment (START) Principles, resource management, and care of EMS personnel on-site. (TN Reading 1, 2, 3, 4, 9; TN Writing 4, 7, 8, 9; EMR-EM, EMR-PH)
- 7) Research and summarize the concepts surrounding vehicle extrication, including safe vehicle extrication, tools used, and patient considerations. Include in the summary common guidelines related to the following: roles of EMS; safety of staff, patients, and situation; vehicle stabilization; unique hazards; additional resources needed; and extrication considerations. (TN Reading 2, 3, 4; TN Writing 4, 9; EMR-EM)

### **Safety and Wellness**

- 8) Develop a reference toolkit of physical, mental, and personal requirements for personnel in emergency and public safety services. Document what the “profile of proficiency” looks like for professionals in these fields—for example, what scores are needed on a physical, mental, or emotional fitness test, and what guidelines must be followed for personal disease/disorder control. (TN Reading 2, 9; TN Writing 2, 4, 6, 8, 9; EMR-P, EM-PH)
- 9) Investigate stress management procedures for professionals in the emergency response and public service sectors. Identify stressors and stress-inducing situations through interviews with professionals in the field. Collaborate with a team to identify techniques and strategies for managing and alleviating stress. Communicate recommendations in the form of a toolkit, brochure, or fact sheet to support the use of these strategies, citing evidence drawn from the investigation. (TN Reading 1, 2, 9; TN Writing 4, 6; EMR-P)
- 10) Compare and contrast in a digital or written artifact the difference in Standard Precautions, personal protective clothing, and personal protective equipment (PPE) in EMS from other healthcare settings. Outline response steps if exposed to hazardous or bloodborne pathogens.





Demonstrate donning and doffing of all PPE and the care of soiled equipment or vehicles. (TN Reading 2, 3, 4 ; TN Writing 6, 9; EMR-P, EMR-PH)

- 11) Interpret scene management and safety standards and/or protocols by writing a scenario for each of the following situations: (a) traffic or highway incidents, (b) violent encounters, (c) crowds, (d) nature of illness or mechanisms of injury, (e) number of patients and/or victims, and (f) personnel injury prevention. Identify the appropriate responses from EMS professionals and any additional resources that would be involved. (TN Reading 1, 2, 3, 9; TN Writing 2, 9; EMR-P, EMR-EM)
- 12) Review National Incident Management System (NIMS) compliance courses from the *Emergency Preparedness* course, IS-700, IS-800, and ICS 100, in addition to completion of ICS 200 (Single Resources and Initial Action Incidents) and IS-5A (Introduction to Hazardous Materials). Role play scenarios that involve each of these situations and identify roles and responsibilities of the EMR and other team members. (TN Reading 2, 9, FEMA NIMS)

### **EMS and Therapeutic Communications**

- 13) Identify situations and locate agencies an Emergency Medical Responder (EMR) would call for additional assistance upon arrival at a scene. Practice scenarios that would require the transfer of care of the patient, incorporating pertinent information such as the patient's condition, history of what happened, care given, etc. (TN Reading 3, 4, 9; TN Writing 9; EMR-P, EMR-MT)
- 14) Review the concepts of effective therapeutic communication. Examine interview techniques used during therapeutic communication and identify potential hazards of interviewing. (TN Reading 3, 9; EMR-P, EMT-LD)

### **Legal/Ethical Guidelines**

- 15) Interpret the rules, guidelines, and legal ramifications related to incident documentation by EMS staff. Complete a pre-hospital care report utilizing appropriate medical terminology and the acronyms SAMPLE, DCAP-BTLS, and OPQRST. (TN Reading 3, 4, 5; TN Writing 4, 6, 8, 9; EMR-P, EMR-MT)
- 16) Summarize the Health Insurance Portability and Accountability Act (HIPAA). Explain characteristics of consent, confidentiality, advanced directives, living wills, durable power of attorney, and other legal directives governing medical treatment. Using domain-specific language and accurate definitions of legal concepts, explain how the content of these legal documents impacts patients' rights for all aspects of care. (TN Reading 1, 2, 4, 5; EMR-P, EMR-MT)
- 17) Examine real-world situations that involve ethical dilemmas and the application of correct professional conduct as highlighted in recent news articles. Craft an argumentative essay making a claim about the importance of ethics and professional standards for persons working in Emergency Medical Services occupations. Cite examples from case studies to argue for the relevance of professional codes of conduct within scope of practice and how important it is to follow those guidelines. (TN Reading 2, 9; TN Writing 1, 4, 9; EMR-P, EMR-MT)



- 18) Research legal ramifications and responsibilities of the EMR associated with evidence preservation and mandatory reporting requirements within the EMS system. Identify the process for reporting specific situations to the appropriate authorities, such as child abuse and/or crimes. (TN Reading 2, 9; TN Writing 4, 9; EMR-P, EMR-MT)

### **Anatomy/Physiology/Pathophysiology**

- 19) Outline the gross and cellular anatomy and physiology of the musculoskeletal, respiratory, and cardiovascular systems. Discuss acceptable levels of development, vital signs, and psychological norms for all ages, including pediatric and geriatric patients. Review the gross anatomy of the other systems studied in previous courses. (TN Reading 2; TN Writing 8, 9; TN A&P 1, 2, 3, 4; EMR-AP, EMR-PT, EMR-LD, EMT-MT)

### **Patient Assessment/Evaluation and Treatment**

- 20) Accurately perform the components of patient assessment to identify and manage immediate life threatening illnesses and injuries within the scope of practice of the EMR for pediatric, adult, and geriatric patients, utilizing rubrics from textbooks, National HOSA guidelines, or clinical standards of practice. Include the following areas:

- a. Scene Size-up
- b. Primary Survey or Assessment
- c. History Taking
- d. Secondary Assessment
- e. Reassessment

(TN Reading 3, 4; EMR-A, EMR-MT, EMR-SP)

- 21) Identify and perform skills to manage life threatening illnesses based on assessment findings of a pediatric, adult, and geriatric patient with medical emergencies, utilizing rubrics from textbooks, National HOSA guidelines, or clinical standards of practice in the following areas:

- a. Altered mental status
- b. Seizures
- c. Stroke
- d. Gastrointestinal bleeding
- e. Anaphylaxis
- f. Infectious diseases
- g. Diabetes
- h. Psychological emergencies
- i. Chest pain
- j. Poisoning
- k. Respiratory distress/Asthma
- l. Vaginal bleeding
- m. Nosebleeds

(TN Reading 3, 4; EMR-M, EMR-A, EMR-AW, EMR-AP, EMR-Phar, EMR-S, EMR-SP)

- 22) Use assessment information to recognize shock, respiratory failure or arrest, and cardiac arrest based on assessment findings. Demonstrate the ability to manage the situation while awaiting additional emergency response. (TN Reading 4, 9; TN Writing 4; EMR-S, EMR-AW, EMR-AP, EMR-PT)



- 23) Successfully perform American Red Cross or American Heart Association adult, child, and infant Basic Life Support (BLS) cardiopulmonary resuscitation (CPR) for Healthcare Providers or BLS for PreHospital Providers. (TN Reading 3, 4; EMR-M, EMR-T, EMR-AP, EMR-MT, EMR-S)EMR-SP)
- 24) Research and evaluate National Trauma Triage Protocol. Identify and perform skills to manage life threatening injuries based on assessment findings of a patient with trauma emergencies, utilizing rubrics from textbooks, National HOSA guidelines, or clinical standards of practice in the following areas:
- Internal and external bleeding
  - Chest trauma such as sucking chest wound and impaled objects in chest
  - Abdominal trauma such eviscerations and impaled objects
  - Orthopedic trauma such as fractures, dislocations, amputations
  - Soft tissue trauma, burns, dressings, and bandages
  - Head, facial, neck and spine trauma such as head injuries, scalp injuries, and injuries to spine
  - Environmental emergencies such as submersion and exposure to heat and cold
  - Multi-system trauma
- (TN Reading 3, 4; EMR-T, EMR-MT, EMR-S, EMR-AP, AMR-PT, EMR-SP)
- 25) Recognize and manage life threats based on simple assessment findings for a patient with special needs while awaiting additional emergency response. Utilize rubrics from textbooks, National HOSA guidelines, or clinical standards of practice for the following special patient populations and situations:
- Vaginal bleeding in pregnant patients
  - Signs of labor and delivery
  - Steps if EMR needs to deliver
  - Initial care of neonates
  - Care of mother after delivery
  - Pediatric respiratory distress, seizures, and Sudden Infant Death Syndrome (SIDS)
  - Geriatric care
  - Child, elderly, and domestic partner abuse
- (TN Reading 3, 4; EMR-SP, EMR-AP, EMR-A, EMR-LD, EMR-MT, EMR-S, EMR-M, EMR-T)

## Portfolio

- 26) Compile and continually update a portfolio of artifacts completed in this course. If pursuing EMR certification or dual enrollment/dual credit hours, document hours spent on activities such as job shadowing or classroom contact with an articulated institution. Upon completion of the course, prepare the portfolio in a professional style to present to appropriate EMS audiences. The following artifacts will reside in the student's portfolio:
- Career Exploration portfolio
  - Skills performance rubrics
  - Documentation of job shadowing hours
  - Classroom contact hours, if applicable
  - Examples of written, oral, or digital presentations
  - Short research project documents
- (TN Reading 1, 2, 3, 4, 8, 9; TN Writing 2, 4, 8, 9; EMR-P1, EMR-P)



## Standards Alignment Notes

\*References to other standards include:

- National Highway Traffic Safety Administration National Emergency Medical Services Education Standards for Emergency Medical Responders (EMR).
  - All standards are aligned to the [National EMS Educational Standards](#) and [EMR Instructional Guidelines](#) and approved by the Tennessee Department of Emergency Medical Services.
  - Key for alignment: P-Preparatory, AP-Anatomy and Physiology, MT-Medical terminology, PT-Pathophysiology, LD- Life Span Development, PH-Public Health, Pharm-Pharmacology, AW-Airway Management, Respirations and Artificial Ventilation, A-Assessment, M-Medicine, S-Shock and Resuscitation, T-Trauma, SP-Special Patient Populations, EM-EMS Operations
- TN Reading: [Tennessee State Standards for English Language Arts & Literacy in History/Social Studies, Science, and Technical Subjects](#); Reading Standards for Literacy in Science and Technical Subjects 6-12; Grades 11-12 Students (page 62).
  - Note: While not directly aligned to one specific standard, students who are engaging in activities outlined above should be able to also demonstrate fluency in Standard 10 at the conclusion of the course.
- TN Writing: [Tennessee State Standards for English Language Arts & Literacy in History/Social Studies, Science, and Technical Subjects](#); Writing Standards for Literacy in History/Social Studies, Science, and Technical Subjects 6-12; Grades 11-12 Students (pages 64-66).
  - Note: While not directly aligned to one specific standard, students who are engaging in activities outlined above should be able to also demonstrate fluency in Standards 5 and 10 at the conclusion of the course.
- P21: Partnership for 21st Century Skills [Framework for 21st Century Learning](#)
  - Note: While not all standards are specifically aligned, teachers will find the framework helpful for setting expectations for student behavior in their classroom and practicing specific career readiness skills.
- Federal Emergency Management Agency, [National Incident Management Systems](#) Emergency Management Institute curriculum





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## Exercise Science

<b>Primary Career Cluster:</b>	Health Science
<b>Consultant:</b>	Sheila Carlton, (615) 532-2839, <a href="mailto:Sheila.Carlton@tn.gov">Sheila.Carlton@tn.gov</a>
<b>Course Code(s):</b>	TBD
<b>Prerequisite(s):</b>	<i>Rehabilitation Careers</i> prerequisite; <i>Anatomy and Physiology</i> , co-requisite
<b>Credit:</b>	1
<b>Grade Level:</b>	11-12
<b>Graduation Requirements:</b>	This course satisfies one of three credits required for an elective focus when taken in conjunction with other Health Science courses.
<b>Programs of Study and Sequence:</b>	This is the third course in the <i>Clinical Exercise Physiology</i> program of study.
<b>Necessary Equipment:</b>	Refer to the Teacher Resources page.
<b>Aligned Student Organization(s):</b>	HOSA: <a href="http://www.tennesseehosa.org">http://www.tennesseehosa.org</a> Amanda Hodges, (615) 532-6270, <a href="mailto:Amanda.Hodges@tn.gov">Amanda.Hodges@tn.gov</a>
<b>Coordinating Work-Based Learning:</b>	If a teacher has completed work-based learning training, he or she can offer placement in Job Shadowing or Clinical Internship. Please visit <a href="http://www.tn.gov/education/cte/work_based_learning.shtml">http://www.tn.gov/education/cte/work_based_learning.shtml</a> for more information.
<b>Available Student Industry Certifications:</b>	None
<b>Dual Credit or Dual Enrollment Opportunities:</b>	There are no known dual credit/dual enrollment opportunities for this course. If interested in developing, reach out to a local postsecondary institution to establish an articulation agreement.
<b>Teacher Endorsement(s):</b>	577
<b>Required Teacher Certifications/Training:</b>	None
<b>Teacher Resources:</b>	<a href="http://www.tn.gov/education/cte/HealthScience.shtml">http://www.tn.gov/education/cte/HealthScience.shtml</a>

### Course Description

*Exercise Science* is an applied course designed to prepare students to pursue careers in kinesiology and exercise physiology services. Upon completion of this course, proficient students will be able to apply concepts of anatomy and physiology, physics, chemistry, bioenergetics, and kinesiology to specific exercise science contexts. Through these connections students will understand the importance that exercise, nutrition, and rehabilitation play in athletes or patients with debilitating or acute metabolic,

orthopedic, neurological, psychological, and cardiovascular disorders. In addition, students have the opportunity to incorporate communication, goal setting, and information collection skills in their coursework in preparation for future success in the workplace. Standards in this course are aligned with Tennessee State Standards for English Language Arts & Literacy in Technical Subjects, Tennessee State Standards in Mathematics, and Tennessee Anatomy and Physiology standards.\*

## Program of Study Application

This is the third course in the *Clinical Exercise Physiology* program of study. For more information on the benefits and requirements of implementing this program in full, please see the program of study description documents found on the Health Science website at <http://www.tn.gov/education/cte/HealthScience.shtml>.

## Course Standards

### Exercise Science as a Career

- 1) Define exercise physiology and link to the careers within the Clinical Exercise Physiology career pathway as a cardiac rehabilitation therapist, certified strength and conditioning coach, personal trainer, lifestyle and weight management coach, athletic trainer, and corporate wellness supervisor/instructor. Explain in detail the education level, credentialing/licensure requirements, and continuing education unit requirements necessary for success in these fields, as well as state and national compliance guidelines. Research professional organizations and codes of ethics associated with these occupations. (TN Reading 2, 9; TN Writing 4, 9)
- 2) Compare and contrast the roles and responsibilities of professionals in exercise physiology with those of professionals in other rehabilitation areas. Research and debate in an oral, written, or digital format the differences in client-therapist/trainer relationships, entities of risk management, liability issues, and protocols for working with special populations. (TN Reading 1, 2, 9; TN Writing 1, 6, 8, 9)
- 3) Develop an oral, written, or digital presentation explaining the relationship of exercise physiology professionals with other healthcare and community professionals, especially related to concerns over encroachment and role delineation. Provide suggestions to promote a working, team-building environment. (TN Reading 2, 9; TN Writing 4, 6, 9)
- 4) Design a detailed written or digital artifact explaining the correlation of the sciences of physics, chemistry, biology, anatomy and physiology, bioenergetics, and kinesiology to the emerging science surrounding exercise physiology. Include in the explanation at minimum the following: current research, new technologies and treatments, governmental initiatives, and injury/illness prevention. (TN Reading 1, 2, 4; TN Writing 2, 4, 6, 8, 9)
- 5) Complete a literature review analyzing at least three peer-reviewed articles to answer a research question surrounding the history, development, and future of exercise physiology as a scientific discipline. Document findings in an informational text using appropriate citation conventions, integrating quantitative and graphic information from the articles reviewed. (TN Reading 1, 2, 4, 7; TN Writing 2, 4, 8, 9)



## Anatomy and Physiology

- 6) Research the theories of the Specific Adaptation to Imposed Demands (S.A.I.D.) principle and the Frequency, Intensity, Type, and Time (F.I.T.T.) principle. Explain the application of these principles to exercise and fitness, then describe the changes that occur within normal anatomy and physiology associated with these theories. (TN Reading 1, 2, 4, 8, 9; TN Writing 8, 9)
- 7) Review the *Physical Activity Guidelines Advisory Committee Report* (latest edition) from the U.S. Department of Health. Explain the scientific evidence surrounding participation in regular physical activity and exercise and its association with positive health outcomes, especially involving the cardiovascular, musculoskeletal, and respiratory systems. (TN Reading 1, 2, 4, 6, 7, 9; TN Writing 4, 9)
- 8) Review the gross and cellular anatomy and physiology of the musculoskeletal, nervous, and cardiovascular systems. Define the terms neuromuscular integration and central command. Summarize how neuromuscular integration, central command, and training and/or rehabilitation plans are based on the integration of the muscle nerve with the muscles of these systems. (TN Reading 2, 9 ; TN Writing 4, 8, 9)
- 9) Identify the two types of muscle fibers and their subtypes, slow twitch and fast twitch. Relate the concepts of histochemistry, immunocytochemistry, and physiologic contraction times to the performance of athletes in various sports. Evaluate the role genetics and training play in muscle fiber adaptations. From this research, generate an informational artifact to share with athletes or clients as part of an exercise/training program. (TN Reading 1, 2, 4, 7, 9; TN Writing 2, 4, 8, 9)
- 10) Review the gross and cellular anatomy and physiology of the respiratory system and explain the ventilation process. Develop an exercise program and a rehabilitation plan for a patient/client who has coronary pulmonary obstructive disease (COPD) and one who is training for a marathon, based on their respective respiratory needs. Compare and contrast these plans to justify the components included. (TN Reading 1, 3, 4, 9; TN Writing 4, 7, 9)
- 11) Compare and contrast the functions of the cardiovascular system in response to aerobic exercises. Cite the specific changes that are likely to occur and the part of the anatomy that is involved. Using this information, develop a public service announcement, health education/public health presentation, or community awareness brochure to educate local citizens about the importance of exercise in maintaining positive cardiovascular health. (TN Reading 2, 3, 4, 7, 9; TN Writing 4, 6, 8, 9)

## Adaptations to Exercise

- 12) Explain why adaptations must be made to exercise programs to account for different clients' needs. Given a scenario or profile of a client/patient, develop an exercise program with the following adaptations:
  - a. Immediate effects of exercise
  - b. Long term effects of exercise (heart/lungs/weight control/disease prevention)
  - c. Effects of acclimatization (such as changes in temperature, altitude, climate, etc.)
  - d. Effects of travel on the client and/or athlete





e. Medications

(TN Reading 2, 3, 4; TN Writing 8, 9)

- 13) Review the concepts of kinesiology and biomechanics from the Rehabilitation Careers course. Explain how joint and bone movement, body motion, and levers can have positive or negative effects on an athlete's performance and development. In a presentation or speech intended for an audience of young athletes, describe the effects of overtraining on the musculoskeletal system, and relate the importance of adopting safe biomechanical practices when training. (TN Reading 1, 2, 4, 9; TN Writing 4, 6, 9)

**Nutrition**

- 14) Gather relevant information from multiple authoritative print and digital sources related to the importance of a balanced diet in the achievement of optimum nutrition and exercise. Compare and contrast the nutritional needs of a normal healthy diet with the needs of other clients, such as those training for an intensive sporting event, those with cardiac disease, or those being treated for and/or recovering from illness. Prepare an informative artifact to discuss the findings. (TN Reading 1, 2, 4, 9; TN Writing 2, 8, 9)
- 15) Investigate the chemical makeup of various sports drinks. In an argumentative essay, debate the nutritional value of these drinks compared to water as a form of hydration, electrolyte replacement, and vitamin replenishment for athletes. State the advantages and disadvantages of each and the dangers that are likely to occur with inappropriate hydration techniques and/or dehydration. Discuss the importance of hydration before, during, and after a sporting event, as well as the factors that affect the hydration process. (TN Reading 1, 2, 9; TN Writing 1, 7, 8, 9)
- 16) Access a variety of sources, such as professional journals and/or websites, textbooks, and news articles, regarding appropriate nutritional intake recommendations for athletes. Develop a pre- and post-sport activity meal plan for adolescent, young adult, middle age, and older adult athletes in contact and non-contact sports. Include in the meal plan carbohydrate loading, carbohydrate maintenance, protein loading, and nutritional needs for anaerobic versus aerobic exercise. Revise the plan as new information and circumstances arise. (TN Reading 1, 2, 3, 4, 9; TN Writing 4, 5, 8, 9)
- 17) Cite textual evidence from academic research or nutritional literature to explain how chemical energy contained in glucose, fats, and amino acids is converted to adenosine triphosphate (ATP). In a written, oral, or digital presentation, describe how this process is important in the following areas of practice: health/fitness, medicine, athletic performance, and rehabilitation. (TN Reading 1, 2, 9; TN Writing 4, 6, 9)
- 18) Choose a health parameter relevant to weight management disorders, such as the presence of anorexia nervosa in teens. Research local incidence information and investigate the scope of the disease/disorder in vulnerable populations. Compare that data to similar state, regional, and national information. Develop an action plan for addressing the weight management disorder for the identified area, complete with an analysis of the pros and cons associated with popular diets, recommended caloric intake, appropriate exercise, and other healthcare interventions. (TN Reading 1, 2, 4, 8, 9; TN Writing 4, 6, 7, 8, 9; TN Math N-Q)



- 19) According to articles in professional journals, ergogenic aids have been theorized to improve athletic performance in a variety of ways. In an informational essay, state the definition of ergogenic aids, identify how they are classified (including those that are banned), and describe documented benefits, dangers, and side effects. (TN Reading 1, 2, 9; TN Writing 2, 4, 8, 9)
- 20) Review the International Olympic Committee's position on banned ergogenic aids and debate the pros and cons of the use of acceptable ergogenic aids, especially related to adolescent athletes. (TN Reading 1, 2, 9; TN Writing 1, 4, 9)

### **Assessment and Fitness Measurement**

- 21) Understand principles of and successfully perform skills related to baseline assessment and fitness measurement, incorporating rubrics from National HOSA guidelines, textbooks, or clinical standards of practice for the following:
- Cardiovascular testing
  - Muscular strength testing
  - Flexibility testing
  - Muscular endurance testing
  - Postural screening
  - Speed testing
  - Balance testing
  - Reaction time testing
  - Coordination testing
  - Agility testing
  - Muscular power testing

(TN Reading 3, 4)

- 22) Understand principles of and successfully perform skills related to biometric measurements, incorporating rubrics from National HOSA guidelines, textbooks, or clinical standards of practice for the following:
- BMI
    - How to calculate
    - Importance of knowing
    - Myths and misconceptions
  - Body fat percentage calculations
  - Girth
  - Waist and hip ratio
  - Resting Heart rate
  - Resting Blood pressure
  - Resting Respiratory rate

(TN Reading 3, 4; TN Writing 9; TN Math N-Q)

### **Exercise Program**

- 23) Identify and explain the components of an exercise plan. Evaluate an exercise plan for a healthy athlete, then compare and contrast the plan with one that has been designed for a patient with cardiac, neurological, or orthopedic difficulties. Note the similarities and differences in a side by side chart. (TN Reading 4, 8; TN Writing 4)



24) Summarize information from professional journals, websites, and organizations that have developed position papers or reports surrounding the training principles listed below. In the summary, identify how each principle can be incorporated into the F.I.T.T. principle covered earlier in the course in order to develop an optimal exercise plan for clients who are currently not involved with exercise.

- a. Goal Setting/Reality principle
- b. Inherent Ability principle
- c. Intrinsic Motivation principle
- d. Client Education Model principle
- e. Physical Assessment principle
- f. Overload/Progressive principle
- g. Specificity principle
- h. Trainability principle
- i. Periodization principle
- j. Overtraining principle
- k. Detraining principle

(TN Reading 1, 2, 4, 6, 9; TN Writing 2, 4, 7, 8, 9)

25) Complete a consultation and evaluation of a patient/client who is preparing for an intense athletic event, recovering from a cardiovascular illness/injury, making lifestyle modifications to improve health, or is required to improve health for work/insurance reasons. Ensure that the evaluation covers therapeutic communication and psychology, nutrition, cardiovascular and muscular strength and endurance, acute variables that will affect training/rehabilitation, and training goals. Document findings in an authentic template using appropriate medical terminology. (TN Reading 2, 3, 4, 8, 9; TN Writing 4, 6, 8, 9)

26) Utilizing information from the consultation, evaluation, fitness testing, and biometric measurements previously obtained, develop and document using appropriate medical terminology an exercise/rehabilitation program for each of the following:

- a. Juvenile athlete
- b. Adult athlete
- c. Senior adult athlete
- d. Cardiovascular rehabilitation
- e. Morbid obese with a co-morbidity

(TN Reading 2, 4, 7, 8, 9; TN Writing 4, 5, 6, 7, 8, 9)

## Standards Alignment Notes

\*References to other standards include:

- TN Reading: [Tennessee State Standards for English Language Arts & Literacy in History/Social Studies, Science, and Technical Subjects](#); Reading Standards for Literacy in Science and Technical Subjects 6-12; Grades 11-12 Students (page 62).
  - Note: While not directly aligned to one specific standard, students that are engaging in activities outlined above should be able to also demonstrate fluency in Standard 10 at the conclusion of the course.



- TN Writing: [Tennessee State Standards for English Language Arts & Literacy in History/Social Studies, Science, and Technical Subjects](#); Writing Standards for Literacy in History/Social Studies, Science, and Technical Subjects 6-12; Grades 11-12 Students (pages 64-66).
  - Note: While not directly aligned to one specific standard, students that are engaging in activities outlined above should be able to also demonstrate fluency in Standards 3 and 10 at the conclusion of the course.
- TN Math: [Tennessee State Standards for Mathematics](#); Math Standards for High School: Number and Quantity.
  - Note: The standards in this course are not meant to teach mathematical concepts. However, the concepts referenced above may provide teachers with opportunities to collaborate on lesson planning. Students who are engaging in activities listed above should be able to demonstrate quantitative reasoning as applied to specific technical concepts. In addition, students will have the opportunity to practice the habits of mind as described in the eight Standards for Mathematical Practice.
- TN A&P: Tennessee Science: [Anatomy and Physiology](#)
- P21: Partnership for 21st Century Skills [Framework for 21st Century Learning](#)
  - Note: While not all standards are specifically aligned, teachers will find the framework helpful for setting expectations for student behavior in their classroom and practicing specific career readiness skills.





TENNESSEE DEPARTMENT OF  
**EDUCATION**  
FIRST TO THE TOP

## Clinical Internship

<b>Primary Career Cluster:</b>	Health Science
<b>Consultant:</b>	Sheila Carlton, (615) 532-2839, <a href="mailto:Sheila.Carlton@tn.gov">Sheila.Carlton@tn.gov</a>
<b>Course Code(s):</b>	5993
<b>Prerequisite(s):</b>	Any Health Science course with the exception of Health Science Education, Medical Terminology, and Anatomy and Physiology
<b>Credit:</b>	1-4
<b>Grade Level:</b>	11-12; <i>Students must be at least 16 years old to be enrolled in this course</i>
<b>Graduation Requirements:</b>	This course satisfies one of three credits required for an elective focus when taken in conjunction with other Health Science courses.
<b>Programs of Study and Sequence:</b>	This is the final course in the <i>Diagnostic Services, Health Informatics, and Therapeutic Clinical Services</i> programs of study. May be incorporated in <i>Emergency Services</i> POS after completion of the Emergency Medical Services course, or the <i>Therapeutic Nursing Services</i> POS after Nursing Education, or <i>Public Health</i> POS after Community and Behavioral Health.
<b>Necessary Equipment:</b>	Refer to the Teacher Resources page.
<b>Aligned Student Organization(s):</b>	HOSA: <a href="http://www.tennesseehosa.org">http://www.tennesseehosa.org</a> Amanda Hodges, (615) 532-6270, <a href="mailto:Amanda.Hodges@tn.gov">Amanda.Hodges@tn.gov</a>
<b>Coordinating Work-Based Learning:</b>	Teacher must have completed work-based learning training and attended an eight hour state approved Clinical Internship training before teaching this course. For more information, please visit <a href="http://www.tn.gov/education/cte/work_based_learning.shtml">http://www.tn.gov/education/cte/work_based_learning.shtml</a> .
<b>Available Student Industry Certifications:</b>	Combined with pre-requisite courses in Pharmacological Science, Cardiovascular Services, Diagnostic Medicine, and Health Information Technology
<b>Dual Credit or Dual Enrollment Opportunities:</b>	There are dual credit/dual enrollment opportunities for this course when combined with pre-requisite courses. Contact a local postsecondary institution to establish an articulation agreement.
<b>Teacher Endorsement(s):</b>	577
<b>Required Teacher Certifications/Training:</b>	Teachers who have never taught Clinical Internship MUST attend an 8-hour training provided by Department of Education and must also attend work-based learning training.
<b>Teacher Resources:</b>	<a href="http://www.tn.gov/education/cte/HealthScience.shtml">http://www.tn.gov/education/cte/HealthScience.shtml</a>

## Course Description

*Clinical Internship* is a capstone course and work-based learning experience designed to provide students with real-world application of skills and knowledge obtained in a pre-requisite Health Science course. Upon completion of this course, students proficient in *Clinical Internship* will be able to pursue certification in the pre-requisite course of Cardiovascular Services or Pharmacological Science once they have graduated and reached 18 years of age. Prior to beginning work at a clinical site, students must be certified in Basic Life Support (BLS) Cardiopulmonary Resuscitation (CPR), and deemed competent in basic first aid, body mechanics, Standard Precaution guidelines, and confidentiality. Business Management & Administration concentrators may also take this course as part of a career practicum/work-based learning placement within the Health Services Administration program of study. Standards in this course are aligned with Tennessee State Standards for English Language Arts & Literacy in Technical Subjects and Tennessee work-based learning guidelines.

*Note:* Student to teacher ratio for this course is 15:1 in a clinical setting.

## Program of Study Application

This is the final course in the *Diagnostic Services*, *Health Informatics*, and *Therapeutic Clinical Services* programs of study. May be incorporated in *Emergency Services* POS after completion of the Emergency Medical Services course, or the *Therapeutic Nursing Services* POS after Nursing Education, or *Public Health* POS after Community and Behavioral Health. For more information on the benefits and requirements of implementing these programs in full, please visit the Health Science website at <http://www.tn.gov/education/cte/HealthScience.shtml>.

## Course Standards

- 1) Accurately read and interpret safety guidelines appropriate for the roles and responsibilities of an employee of a healthcare facility. Listen to safety instructions and be able to explain why certain rules apply. Demonstrate safety techniques and follow all applicable facility policies and procedures (such as Standard Precautions) related to the clinical placement. Based on placement, document completion of training topics on the appropriate work-based learning (WBL) and work site forms. (TN Reading 2, 3, 4; TN Writing 4)
- 2) Develop a personalized student-learning plan, in accordance with approved policies, to address the methods for practicing and demonstrating each of the skills identified in the pre-requisite health science course standards. Relate how each skill applies to a placement in a healthcare setting, and document day-to-day applications. Participate in ongoing review and communications around progress of plan with Health Science WBL Coordinator. (TN Reading 1, 2, 3, 4, 9; TN Writing 2, 4, 6, 7, 8, 9)
- 3) Observe and analyze organizational culture and practices. For example, analyze how to interact with supervisors, clients, and co-workers, and how to recognize and address health, safety, and sustainability issues. Seek information from supervisors and other employees about appropriate methods of pursuing employment in the industry, and determine what knowledge, skills, and educational credentials are required. (TN Reading 2, 9)
- 4) Apply learning experiences from clinical placement to review and update an education and career pathways plan based on the knowledge and feedback acquired. Proactively identify areas



of strength and opportunities for professional growth, encourage and act on feedback from peers, supervisors, and customers, and seek and use resources and support to improve skills. (TN Reading 4)

- 5) Identify and ask significant questions to solve student-identified challenges or areas of improvement in the workplace. Use inductive and deductive reasoning methods to recognize faulty reasoning, and to understand problems and alternative solutions. (TN Reading 2, 8; TN Writing 7, 9)
- 6) Analyze patient quality assurance methods used by clinical sites. Solve problems using systems thinking, e.g., by understanding problems in terms of complex processes and environments. Identify key components and relationships that enable, influence, and produce outcomes. (TN Reading 3, 7, 8; TN Writing 7, 9)
- 7) Review the Health Insurance Portability and Accountability Act (HIPAA) concepts and investigate methods to assure confidentiality within the healthcare setting. Employ techniques to ensure the client/patient's rights are maintained. (TN Reading 1, 2, 4, 9; TN Writing 9)
- 8) Demonstrate integrity and ethical behavior when engaging in all worksite activities, including the use of tools and materials, documentation of hours, handling of money, billing of clients, sharing of information, and completion of all personnel-related forms. Identify an actual or potential work site ethical issue and construct an argumentative essay outlining how to the issue should be resolved, including claims and counterclaims with relevant data to support conclusions. (TN Reading 4; TN Writing 1, 4, 8)
- 9) Articulate ideas effectively in written personal communications with supervisors, coworkers, and customers using appropriate medical terminology. Verbally articulate ideas effectively in interpersonal communications with supervisors, coworkers, and customers. Develop and deliver messages effectively in oral presentations. Demonstrate effective listening skills, attending to the meaning and intention of communication, and accurately paraphrasing what has been heard. Communicate effectively with individuals of diverse backgrounds who may also speak languages other than English, using foreign language skills and facility resources as appropriate. (TN Reading 3, 4, 9; TN Writing 4, 5)
- 10) Work effectively as a member of a team and address conflict with sensitivity and respect for diverse points of view. Demonstrate understanding of one's own impact and build on different perspectives to strengthen joint efforts. Demonstrate leadership where appropriate to collaborate on workplace tasks. Effectively employ meeting management strategies, such as agenda setting, time keeping, and meeting facilitation strategies, and list action items to identify and schedule next steps. (TN Reading 4)
- 11) Access information efficiently, using sources appropriate to task, purpose, and audience. Distinguish between credible and non-credible sources, including the difference between advertising and legitimate research. Evaluate information for usefulness, bias, and accuracy, and question information that may not originate from credible sources. Demonstrate the ability to organize and manage information effectively and efficiently. Demonstrate ethical and legal use of information, including adherence to all rules and regulations related to sharing of protected information. (TN Reading 2, 3, 4, 9; TN Writing 4, 8, 9)





- 12) Use appropriate technology in the classroom or clinical setting for information search and retrieval, synchronous and asynchronous communications, multimedia presentations, document production, quantitative and qualitative analysis, and information management. Use social networking and online collaboration tools such as shared documents and web conferencing to create, integrate, and manage information in group projects. (TN Reading 2, 9; TN Writing 6, 9)
- 13) Access and manage online communication and information, such as electronic medical records, using multiple digital devices such as laptop computers, tablets, smart phones, etc. Demonstrate adherence to all rules and regulations related to the use of electronic tools and the Internet, including appropriate protection of passcodes and adherence to all security protocols. (TN Reading 3, 7, 8, 9; TN Writing 6, 9)
- 14) Complete tasks as directed with supervision, knowing when to ask questions or request guidance. Exhibit resourcefulness and initiative in taking on new tasks and solving problems independently as appropriate to the workplace setting. Demonstrate how to learn and exhibit personal agency in identifying and achieving instrumental and ultimate learning objectives. Demonstrate curiosity to learn more about the tasks, workplace, and/or industry. Explore deeper content independently and request opportunities for professional development. Demonstrate self-efficacy and confidence in one's ability to succeed in specific situations. (TN Reading 3, 4 ; TN Writing 8, 9)
- 15) Exhibit professionalism and respect when interacting with coworkers, supervisors, and customers. Demonstrate reliability and responsibility in attendance and in following through on assigned tasks, and provide timely communication with supervisor(s) when circumstances change. Understand and adhere to appropriate workplace non-discrimination standards on the basis of sex, race, color, age, national origin, religion, disability, marital status, sexual orientation, gender identity, pregnancy, veteran status, or any characteristic of a person or group unrelated to the workplace. Respect cultural differences and work effectively with people from diverse social and cultural backgrounds.
- 16) Exhibit flexibility by (a) adapting to varied roles, jobs responsibilities, schedules and contexts; (b) working effectively in a climate of ambiguity and changing priorities; and (c) dealing positively with praise, setbacks, and constructive criticism.
- 17) Manage time and projects effectively by (a) setting goals; (b) developing and using a system for prioritizing, planning and managing daily work; (c) persisting in the face of challenges; and (d) seeking assistance and adjusting plans to adapt to changing circumstances. Demonstrate attention to detail and accuracy appropriate to the task. Demonstrate accountability to supervisors, coworkers, and customers by delivering work to agreed-upon standards; accepting constructive criticism; completing designated projects on time; and exhibiting pride in workmanship.
- 18) Update the Health Science student portfolio that illustrates mastery of skills and knowledge outlined in the Health Science pre-requisite course standards and applied in the Clinical Internship experience. Compile artifacts and similar work products reflecting thoughtful assessment and evaluation of the progression against goals in the personal growth plan. Artifacts may include:



- a. Career and professional development plan
  - b. Resume
  - c. Documentation of clinical hours at each site
  - d. List of responsibilities undertaken throughout the placement
  - e. Examples of materials developed and used throughout the placement
  - f. Periodic journal entries reflecting on tasks and activities
  - g. Supervisor evaluations and observations
  - h. Approved WBL forms
  - i. WBL coordinator evaluations and observations
- (TN Reading 1, 3, 4, 9; TN Writing 2, 4, 8, 9)

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- P21: Partnership for 21st Century Skills [Framework for 21st Century Learning](#)
  - Note: While not all standards are specifically aligned, teachers will find the framework helpful for setting expectations for student behavior in their classroom and practicing specific career readiness skills.
- TN WBL: [Tennessee Work-Based Learning Standards](#)

