

# Exercise Science

<b>Primary Career Cluster:</b>	Health Science
<b>Course Contact:</b>	<a href="mailto:CTE.Standards@tn.gov">CTE.Standards@tn.gov</a>
<b>Course Code(s):</b>	C14H22
<b>Prerequisite(s):</b>	<i>Rehabilitation Careers</i> (C14H08)
<b>Credit:</b>	1
<b>Grade Level:</b>	11-12
<b>Focused Elective 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>POS Concentrator:</b>	This course satisfies one out of two required courses to meet the Perkins V concentrator definition, when taken in sequence in the approved program of study.
<b>Programs of Study and Sequence:</b>	This is the fourth course in the <i>Clinical Exercise Physiology</i> program of study.
<b>Aligned Student Organization(s):</b>	HOSA: <a href="http://www.tennesseehosa.org">http://www.tennesseehosa.org</a>
<b>Coordinating Work-Based Learning:</b>	Teachers are encouraged to use embedded WBL activities such as informational interviewing, job shadowing, and career mentoring. For information, visit <a href="https://www.tn.gov/education/career-and-technical-education/work-based-learning.html">https://www.tn.gov/education/career-and-technical-education/work-based-learning.html</a>
<b>Available Student Industry Credentials:</b>	Credentials are aligned with postsecondary and employment opportunities and with the competencies and skills that students acquire through their selected program of study. For a listing of promoted student industry credentials, visit <a href="https://www.tn.gov/education/career-and-technical-education/student-industry-certification.html">https://www.tn.gov/education/career-and-technical-education/student-industry-certification.html</a>
<b>Teacher Endorsement(s):</b>	577, 720
<b>Required Teacher Certifications/Training:</b>	None
<b>Teacher Resources:</b>	<a href="https://www.tn.gov/education/career-and-technical-education/career-clusters/cte-cluster-health-science.html">https://www.tn.gov/education/career-and-technical-education/career-clusters/cte-cluster-health-science.html</a> Best for All Central: <a href="https://bestforall.tnedu.gov/">https://bestforall.tnedu.gov/</a>

## Course at a Glance

CTE courses provide students with an opportunity to develop specific academic, technical, and 21<sup>st</sup> century skills necessary to be successful in career and in life. In pursuit of ensuring every student in Tennessee achieves this level of success, we begin with rigorous course standards which feed into intentionally designed programs of study.

Students engage in industry relevant content through general education integration and experiences such as career & technical student organizations (CTSO) and work-based learning (WBL). Through these experiences, students are immersed with industry standard content and technology, solve industry-based problems, meaningfully interact with industry professionals, and use/produce industry specific, informational texts.

### Using a Career and Technical Student Organization (CTSO) in Your Classroom

CTSOs are a great resource to put classroom learning into real-life experiences for your students through classroom, regional, state, and national competitions, and leadership opportunities. Below are CTSO connections for this course, note this is not an exhaustive list.

- Participate in CTSO Fall Leadership Conference to engage with peers by demonstrating logical thought processes and developing industry specific skills that involve teamwork and project management
- Participate in contests that highlight job skill demonstration; interviewing skills; community service activities, extemporaneous speaking, and job interview
- Participate in leadership activities such as Organizational Leadership, Prepared Speaking, HOSA Service Project, Creative Problem Solving, and HOSA Service Project.

For more ideas and information, visit Tennessee HOSA at <http://www.tennesseehosa.org/>

### Using Work-based Learning in Your Classroom

Sustained and coordinated activities that relate to the course content are the key to successful work-based learning. Possible activities for this course include the following. This is not an exhaustive list.

- participate in an abbreviated internship in a cardiac rehab clinic or rehab center to follow a patient from intake to graduation from the program.

For more ideas and information, visit <https://www.tn.gov/education/career-and-technical-education/work-based-learning.html>.

## 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.

## Program of Study Application

This is the fourth 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 Health Science website at <https://www.tn.gov/education/career-and-technical-education/career-clusters/cte-cluster-health-science.html>

## Course Standards

### 1. Exercise Science as a Career

- 1.1 Exercise physiology careers: 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.
- 1.2 Roles and responsibilities of exercise physiology professionals: Compare and contrast the **roles and responsibilities of professionals in exercise physiology** with those of **professionals in other rehabilitation areas**. Determine the differences in client-therapist/trainer relationships, entities of risk management, liability issues, and protocols for working with special populations.
- 1.3 Exercise physiology professionals' relationships to other professionals: Explain the **relationship of exercise physiology professionals with other healthcare and community professionals**, related to concerns over encroachment and role delineation. Provide suggestions to promote a working, team-building environment.
- 1.4 History of exercise physiology and connection to other sciences: Research the **history and development of exercise physiology** connecting the sciences of **physics, chemistry, biology, anatomy and physiology, bioenergetics, and kinesiology**. Include the following:

current research, new technologies and treatments, governmental initiatives, and injury/illness prevention.

## 2. Anatomy and Physiology

1. S.A.I.D. and F.I.T.T. principles in exercise and fitness: 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**. Using medical terminology appropriately, 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.
2. Regular physical activity and positive health outcomes: 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.
3. Anatomy and physiology of the musculoskeletal, nervous, and cardiovascular systems: 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.
4. Types of muscle fibers and the role of genetics in training: 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**. Practice sharing this information with athletes or clients as part of an exercise/training program.
5. Anatomy and physiology of the respiratory system: 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 chronic obstructive pulmonary 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.
6. Aerobic exercise and the cardiovascular system: 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 an informative artifact to inform others about the importance of exercise in maintaining positive cardiovascular health.

### 3. Adaptations to Exercise

- 3.1 Exercise program adaptations: 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:
- Immediate effects of exercise
  - Long term effects of exercise (heart/lungs/weight control/disease prevention)
  - Effects of acclimatization (such as changes in temperature, altitude, climate, etc.)
  - Effects of travel on the client and/or athlete
  - Medications
- 3.2 Kinesiology and biomechanics: 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. Share with young athletes, the **effects of overtraining on the musculoskeletal system**, and relate the importance of adopting **safe biomechanical practices** when training.

### 4. Nutrition

- Normal adult nutritional needs: Research the importance of a balanced diet in the achievement of optimum nutrition and exercise. Compare and contrast the nutritional needs of a normal healthy adult 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. Using appropriate medical terminology, prepare an informative artifact to discuss the findings.
- Sport drinks: Investigate the **chemical makeup of various sports drinks**. Compare and contrast 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.
- Nutrition for athletes: Analyze **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.
- Creation of ATP: Explain **how chemical energy contained in glucose, fats, and amino acids is converted to adenosine triphosphate (ATP)**. Describe how this process is important in the following areas of practice: health/fitness, medicine, athletic performance, and rehabilitation.

5. Weight management disorders: Research local incidence information of **weight management disorders**, such as anorexia nervosa and bulimia nervosa, 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. 4.6 Ergogenic aids: According to articles in professional journals, **ergogenic aids** have been theorized to improve athletic performance in a variety of ways. Compare ergogenic aids identifying how they are classified (including those that are banned), and describe documented benefits, dangers, and side effects especially for adolescent athletes.

## 5. Assessment and Fitness Measurement

- 5.1 Baseline assessment and fitness measurement: 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
- 5.2 Biometric measurements: 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

## 6. Exercise Program

- 6.1 Exercise plan: 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.
- 6.2 Training principles: Evaluate and summarize the following **training principles**. In the summary, identify how each principle can be incorporated into the F.I.T.T. principle covered earlier in the course 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
- 6.3 Patient consultation and evaluation: 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.
- 6.4 Individualized exercise/rehabilitation program: 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

## Standards Alignment Notes

\*References to other standards include:

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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.