

## **CTE Exercise Science/Injury Prevention - Course Description**

### Course Overview

This course provides an excellent opportunity for students to explore their interests in the field of health science and medicine, specifically focus towards careers in personal training, strength and conditioning, and sport coaching. This course is aligned with California Career Technical Education Model Curriculum Standards and investigates the field of the Certified Strength and Conditioning Specialist Certification program as well as the NSCA –Certified Personal Trainer Program. This course is designed to familiarize the student with the basics of personal training, specifically the demonstration and execution of exercise technique. This class will prepare students in understanding biomechanics principles to apply to movement in sport and training . Topics that will be explored include systematic strength training, plyometric (explosion) training, speed & agility training, physiology of exercise, and other training methods. Students will be provided quality training opportunities based on the strength training principles. Career technical education standards such as communication, career planning, technology, problem-solving, safety, responsibility, ethics, academic skills, technical knowledge, and teamwork are incorporated into academic units throughout the course.

### **Unit 1 – Safety and Best Practices for High School Athletes**

**Unit Summary:** This unit will go over the daily operations of a strength and conditioning program and facility and how to establish guidelines to help athletes achieve their goals and objectives.. This unit will set a standard of practice that will lead to safe and effective training. The students will learn about potential liabilities and risk management strategies. Students will be introduced to the essentials to build policies and procedures for the training facility.

**Key Terms:** informed consent, liability, emergency action plan, mission statement, negligence, policies, procedures, program goals, risk management, scope of practice, standard of care

#### **Learning Objectives:**

- Create goals and objectives for a strength and conditioning program.
- Explain what it means to have a safe and effective program.
- Identify potential risks in a strength and conditioning facility.
- Apply the proper risk management strategies to potential liabilities.

**Activities:** Students will be presented with a blueprint of a strength and conditioning facility and policies and procedures. The students will then review the content and make corrections to potential liabilities. The students will identify if the facility layout is safe and if the policies and procedures cover a proper standard of practice.

### **Unit 2 – Facility and Equipment Design**

**Unit Summary:** In this unit, students will learn about the different types of equipment and the many functions they can potentially serve. Proper use of equipment will be taught in both free

weight and machine exercise equipment. The students will also learn how to maintain and clean the equipment, as well as procedures in the event a machine does not function properly.

**Key Terms:** design phase, master plan, maintenance, needs analysis, pre design phase,

**Learning Objectives:**

- Describe the proper use of equipment as well as the safety precautions.
- Explain the goal of each piece of equipment.
- Identify if the equipment is safe to use.
- Explain the maintenance and cleaning procedures of the equipment.

**Activities:** Students will research an exercise equipment item of their choice and present on the functions and proper care of the equipment. In the presentation, the students should be able to identify the proper use of the equipment, the goal of the piece of equipment, safety considerations, and proper maintenance and cleaning of the equipment item.

### **Unit 3 –Structures and Function of Body Systems**

**Unit Summary:** The unit will teach the students the fundamentals of the muscular and skeletal systems. This unit will also introduce the sliding-filament theory of muscle contractions. Students will learn about the morphological and physiological characteristics of different muscle fiber types and how they relate to sport. Students will also learn the basics of the cardiovascular and respiratory system.

**Key Terms:** actin, all-or-none principle, appendicular skeleton, artery, AV bundle, AV node, AV valves, axial skeleton, biaxial joints, cartilaginous joints, crossbridge, electrocardiogram (ECG), endomysium, epimysium, fasciculi, fast-twitch fiber, fibrous tissue, golgi tendon organ (GTO), hemoglobin, H-zone, I-band, motor neuron, motor unit, muscle spindle, myofibril, myosin, perimysium, proprioceptor, P-wave, QRS complex, red blood cell, SA node, slow-twitch fiber, sympathetic nervous system, synovial joints, tachycardia, tendon, tetanus, tropomyosin, troponin, type I fiber, type IIa fiber, type IIx fiber, uniaxial joints, vein, vertebral column, Z-line

**Learning Objectives:**

- Identify the function and structure of the muscular system.
- Identify the function and structure of the skeletal system.
- Describe the sliding-filament theory.
- Identify muscle fiber types and the sports they correspond to.
- Explain how the cardiovascular and respiratory system functions.

**Activities:** The students will find research and write a paper in which they look into one of the three muscle fibers in the unit. The students will find research on the physiology of the muscle fiber, the best ways to develop the muscle fiber, which sport the muscle fiber is best suited for, and how the muscle may be damaged.

## Unit 4 –Biomechanics of Resistance Exercise

**Unit Summary:** The unit will dive into major components of skeletal musculature and the various types of levers of the musculoskeletal system. Students will also learn about the primary anatomical movements during sports activities and exercises. The unit will describe the factors contributing to human strength and power, evaluate resistance force and power patterns of exercise devices, and identify factors of importance for joint biomechanics with exercise.

**Key Terms:** agonist, anatomical position, angle of pennation, antagonist, biomechanics, concentric muscle action, eccentric muscle action, first-class lever, fluid resistance, form drag, friction, frontal plane, fulcrum, insertion, isometric muscle action, lever, mechanical advantage, moment arm, muscle force, origin, pennate muscle, power, rate coding, recruitment, resistive force, rotational power, rotational work, sagittal plane, second-class lever, strength, surface drag, tendons, third-class lever, torque, transverse plane, weight, work

### Learning Objectives:

- Identify the primary anatomical movements.
- Explain and describe the levers present in human movement.
- Evaluate patterns of exercise devices.
- Identify how the levers apply to sport and exercise.
- Describe how the levers affect human strength and power.

**Activities:** In this unit, students will film a movement that is relevant to their favorite sport in order to analyze the biomechanics. The students will use a biomechanics app to break down the anatomical planes and levers of the sport movement. Students will evaluate the movement and seek ways that it may be improved.

## Unit 5 –Bioenergetics of Exercise and Training

**Unit Summary:** The unit will introduce students to how energy is used by the body during exercise and sport. Students will learn the basic energy systems available to supply ATP during exercise. The unit will show students how to create programs that demonstrate the metabolic specificity of training. Students will learn about the metabolic demands of recovery from interval training, high intensity interval training, and combination training to optimize work-to-rest ratios.

**Key Terms:** adenosine diphosphate (ADP), adenosine monophosphate (AMP), adenosine triphosphatase (ATPase), adenosine triphosphate (ATP), aerobic, aerobic glycolysis, anabolism, anaerobic, anaerobic glycolysis, bioenergetics, branch-chain amino acid, calcium ATPase, catabolism, combination training, creatine kinase, creatine phosphate (CP), depletion, electron transport chain, (ETC), energy, excess postexercise oxygen consumption (EPOC), fast glycolysis, glycolysis, high-intensity interval training (HIIT), interval training, Kreb's cycle, lactate, lactate threshold (LT), lactic acid, metabolic acidosis, metabolic specificity, metabolism, mitochondria, oxidative system, oxygen debt, oxygen deficit, phosphagen system, phosphocreatine (PCr), repletion, slow glycolysis, work-to-rest- ratio

**Learning Objectives:**

- Explain the energy systems that supply ATP during exercise.
- Explain lactate accumulation.
- Explain metabolic acidosis.
- Identify patterns of substrate depletion and repletion during various exercise intensities.
- Develop training programs that demonstrate the metabolic specificity of training.
- Explain the metabolic demands of multiple training modalities.

**Activities:** Students will identify the primary energy system(s) of the sport of their choice. Once the energy system(s) are identified, the student will create a training program in which the energy system is developed.

**Unit 6 –Endocrine Responses to Resistance Exercise**

**Unit Summary:** This unit will introduce students to the basic concepts of endocrinology, including how the hormones function and how they interact with each other and target tissues. Students will learn about anabolic hormones and the responses of the hormones to resistance exercise.

**Key Terms:** anabolic hormone, catabolic hormone, endocrine gland, General Adaptation Syndrome, hormone, hormone-receptor complex (H-RC), lock and key theory, neuroendocrinology, polypeptide hormone, proteolytic enzyme, secondary messenger, steroid hormone, target tissue cell, thyroid hormone

**Learning Objectives:**

- Describe the roles of hormones in the human body.
- Explain the role of anabolic hormones.
- Describe hormonal responses that occur during resistance training.
- Develop training programs that demonstrate an understanding of human endocrine responses.

**Activities:** Students will do research on a hormone of their choice. Students will write a paper in which they describe the main objective of the hormone, under and over production of the hormone, the hormone as it relates to training, and potential illnesses related to the hormone.

**Unit 7 –Adaptations to Anaerobic Training Programs**

**Unit Summary:** The unit will introduce students to the fundamentals of anaerobic training and how it differs from aerobic training. Students will learn about the anatomical, physiological, and performance adaptations that occur due to anaerobic training. With this information, the unit will show the students how to manipulate training variables to promote enhanced muscular strength, muscular endurance, power, flexibility and motor performance.

**Key Terms:** anaerobic alactic system, anaerobic lactic system, anaerobic training, bilateral deficit, bilateral facilitation, bone matrix, bone mineral density, collagen, cortical bone, cross-education, cross-linking, detraining, elastin, fibrous cartilage, functional overtraining (FOR), hyaline cartilage, hypertrophy, mechanical loading, microfibril, minimal essential strain (MES), motor unit, myotatic reflex, neuromuscular junction (NMJ), nonfunctional overreaching (NFOR), osteoblasts, overreaching, overtraining, overtraining syndrome (OTS), parasympathetic overtraining syndrome, peak bone mass, pennation angle, procollagen, selective recruitment, size principle, specificity of loading, stress fractures, structural exercises, sympathetic overtraining syndrome, tendon stiffness

**Learning Objectives:**

- Explain the difference between anaerobic and aerobic training.
- Explain the central and peripheral neural adaptations to anaerobic training.
- Recognize how the acute training variables of a periodized program can alter bone, muscle, and connective tissue.
- Explain the acute and chronic effects of anaerobic training on the endocrine system.
- Explain the acute and chronic effects of anaerobic training on the cardiovascular system.
- Recognize the causes, signs, symptoms, and effects of anaerobic overtraining and detraining.
- Develop an anaerobic training program.

**Activities:** The students will create a 4 week anaerobic training program and present it to the class. The students will defend their program and answer questions as to why they chose certain variables for their program. Students will participate in another students program, and test if the program goals were met.

## **Unit 8 –Adaptations to Aerobic Endurance Training Programs**

**Unit Summary:** The unit will introduce students to the fundamentals of aerobic training and how it differs from anaerobic training. Students will learn about the anatomical, physiological, and performance adaptations that occur due to aerobic training. The unit will show the students how physiological characteristics of the cardiovascular, respiratory, nervous, muscular, bone, and connective tissue, and endocrine systems are curiila components in the development of aerobic endurance training programs.

**Key Terms:** alveoli, anatomical dead space, blood doping, bradycardia, cardiac output, detraining, diastole, diastolic blood pressure, diffusion, double product, ejection fraction, end-diastolic volume, Frank-Starling mechanism, functional overreaching, heart rate, hyperoxic breathing, hyperventilation, maximal heart rate, maximal oxygen uptake, mean arterial pressure, metabolic equivalent (MET), minute ventilation, mitochondria, myoglobin, nonfunctional overreaching, overtraining, overtraining syndrome (OTS), oxygen uptake, physiological dead space, stroke volume, systole, systolic blood pressure, tapering, tidal volume, vasoconstriction, vasodilation, venous return, ventilatory equivalent

**Learning Objectives:**

- Explain the difference between anaerobic and aerobic training.
- Explain the central and peripheral neural adaptations to aerobic training.
- Explain how the acute and chronic effects of aerobic training can alter bone, muscle, and connective tissue.
- Explain the acute and chronic effects of aerobic training on the endocrine system.
- Explain the acute and chronic effects of aerobic training on the cardiovascular system.
- Identify the the external factors that influence adaptations to acute and chronic aerobic exercise including altitude, sex, blood doping, and detraining.
- Recognize the causes, signs, symptoms, and effects of aerobic overtraining and detraining.
- Develop an aerobic training program.

**Activities:** The students will create a 4 week aerobic training program and present it to the class. The students will defend their program and answer questions as to why they chose certain variables for their program. Students will participate in another students program, and test if the program goals were met.

## **Unit 9 –Age and Sex Related Differences and Their Implications for Resistance Exercises**

**Unit Summary:** The unit will introduce the students to how resistance training programs can have different effects on different populations. Training programs must be designed with the population in mind as each population will have certain needs and limitations. The unit will differentiate needs by sex and age and how they both have differences that need consideration.

**Key Terms:** adolescence, adulthood, amenorrhea, anterior cruciate ligament (ACL), apophyseal, biological age, childhood, chronological age, cocontraction, development, diaphysis, ectomorphic, endomorphic, female athlete triad, growth, growth cartilage, maturation, menarche, mesomorphic, older, osteopenia, osteoporosis, peak height velocity (PHV), preactivation, puberty, puberty, resistance exercise, sarcopenia, senior, training age, youth, young athlete

### **Learning Objectives:**

- Evaluate the evidence regarding the safety, effectiveness, and importance of resistance exercise for children.
- Identify sex-related differences in muscular function and their implications for females.
- Describe the effects of aging on musculoskeletal health and the trainability of older adults.
- Explain why adaptations to resistance exercise can vary greatly among the three distinct populations.

**Activities:** Students will be given “potential clients,” the files will contain information about the client that the students need to take into consideration when creating a program. Students will evaluate the file and create a needs analysis and a contraindications list.

## Unit 10 –Psychology of Athletic Preparation and Performance

**Unit Summary:** The unit will introduce an important aspect of the performance that may be forgotten by coaches when training, and that is psychology. Although the course has a high concentration on physiology, it is important to understand this factor as it has a significant impact on performance. Students will learn about the multiple ways they can tend to physiological needs in order to improve performance.

**Key Terms:** achievement motivation, anxiety, arousal, attention, augmented feedback, autogenic training, catastrophe theory, cognitive anxiety, counterconditioning, diaphragmatic breathing, discovery, distress, drive theory, emotions, enhancement, eustress, explicit instructions, extrinsic motivation, goal setting, guided discovery, ideal performance state, imagery, individual zones of optimal functioning, intrinsic feedback, intrinsic motivation, inverted U-theory, knowledge of performance, knowledge of results, long-term goals, mental imagery, motivation, motive to achieve success (MAS), motive to avoid failure (MAF), negative punishment, negative reinforcement, observational practice, operant, outcome goal, part practice, physiological efficiency, positive punishment, positive reinforcement, process goals, progressive muscle relaxation (PMR), progressive-part training, psychological efficiency, pure-part training, random practice, repetitive part training, reversal theory, routine, segmentation, selective attention, self-confidence, self-controlled practice, self-efficacy, self-talk, short-term goals, simplification, somatic anxiety, stress, stressor, systematic desensitization (SD), trait anxiety, variable practice, whole practice

### Learning Objectives:

- Explain the psychological constructs of arousal, motivation, focus, and confidence.
- Apply psychological constructs and be able to ascertain their impact on physical performance.
- Identify terms relevant to physiological areas of concern, such as anxiety, attention, the ideal performance state, self-efficacy, imagery, and goal setting.
- Recognize how to structure schedules to facilitate skill acquisition and learning.
- Recognize different types of instructions and feedback and their application in a practice and performance setting.

**Activities:** Students will test and review psychology performance practices on themselves. They will practice for a week and journal their observations. Students will use this practice in order to understand how the practice works and if it has any effect on their own performance.

## Unit 11 –Basic Nutrition Factors in Health

**Unit Summary:** The unit will introduce students to foundational nutrition concepts as well as protocols for a number of dietary needs for special populations. Students will learn about how to properly make recommendations and when to refer out to qualified professionals. The basics of proper hydration planning will also be introduced in this unit.

**Key Terms:** Acceptable Macronutrient Distribution Range (AMDR), Adequate Intake (AI), amino acids, anemia, bioavailability, carbohydrate, cholesterol, dehydration, Dietary Reference Intakes (DRIs), disaccharides, electrolytes, Estimated Average Requirement (EAR), fat, fatty acid, fiber, fructose, galactose, gluconeogenesis, glycemic index (GI), glycemic load, glycogen, glycogenesis, glucose, high-density lipoprotein (HDL), hydration, hypohydration, hyponatremia, lactose, low-density lipoprotein (LDL), macronutrient, maltose, micronutrient, minerals, monosaccharides, monounsaturated, muscle protein synthesis, MyPlate, nutrient density, omega-3 fatty acid alphanolenic acid (ALA, polypeptide, polysaccharides, polyunsaturated, protein, protein digestibility, Recommended Dietary Allowances (RDA), saturated, sports dietitian, sucrose, triglycerides, very low-density lipoproteins (VLDL), vitamins

**Learning Objectives:**

- Identify when to refer an athlete to the appropriate resource, a medical doctor or a sports dietitian.
- Identify the protein, carbohydrates, and fat recommendations for athletes.
- Explain the hydration and electrolytes guidelines.
- Develop an individualized hydration plan for athletes.

**Activities:** Students will journal their dietary intake for a week and follow it with a report on their nutrition intake. Students will report on the calories consumed, macronutrients and micronutrient intake as well as hydration. Students will compare their diet to recommended values for age and sex and make needed changes to adjust any deficiencies. Students will make a plan in order to improve their hydration.

**Unit 12 –Nutrition Strategies for Maximizing Performance**

**Unit Summary:** The unit will use the information learned in the previous unit in order to apply the nutrition information to athletes and their needs. Students will learn about how nutrition needs change from offseason and inseason and various sports. The unit will show students how to better intervene with athletes and be aware of potential nutritional issues such as obesity and eating disorders.

**Key Terms:** anorexia, binge-eating disorder, body mass index (BMI), bulimia nervosa, carbohydrate loading, diet-induced thermogenesis, disordered eating, isocaloric, obesity, precompetition meal, voluntary dehydration

**Learning Objectives:**

- Recognize pre-, during, and postcompetition nutrition recommendations for different sports.
- Explain guidelines for weight gain and weight loss.
- Recognize signs and symptoms of eating disorders.

- Describe the importance of having an intervention and referral system in place for athletes suspected of having an eating disorder.
- Recognize the prevalence and etiologies of obesity.
- Develop an assessment process for obese individuals.

**Activities:** Students will create a research project in which they are to look into the effects of an eating disorder of their choice. The students will examine specific populations that are most susceptible to the eating disorder, the signs and symptoms, intervention, and potential prevention practices.

### **Unit 13 –Performance-Enhancing Substances and Methods**

**Unit Summary:** This unit will provide information to allow students to think critically when dealing with performance enhancement supplements. Students will learn about what the research says in regards to the most popular substances on the risk and benefits. Students will also learn about common practices and if the methods are supported by science and research.

**Key Terms:** anabolic steroid, B-agonist, branched-chain amino acids, dietary supplement, ergogenic aid, ergolytic, erythropoietin, essential amino acids, human growth hormone (HGH), lipolysis, muscle buffering capacity (MBC), muscle dysmorphia, random drug tests, stacking, testosterone, thermogenesis, vasodilation

#### **Learning Objectives:**

- Recognize reliable and up-to-date information to athletes on the risks and benefits of performance-enhancing substances, including anabolic steroids.
- Describe the efficacy and adverse effects of over-the-counter dietary supplements marketed to athletes for enhancing sport and exercise performance.
- Determine which performance-enhancing supplements are beneficial for strength/power performance, endurance performance, or both.
- Distinguish between those performance-enhancing supplements that mimic the effects of hormones in the body and those that improve performance through some other means.

**Activities:** Students will present on a performance-enhancing supplement of their choice. Students will present the effects the supplement creates, the history of the supplement, common methods, the risks and benefits, and if they recommend the supplement.

### **Unit 14 –Principles of Test Selection and Administration**

**Unit Summary:** The unit will introduce students on how testing and measurements can be used to make decisions that help athletes and increase performance. Students will learn how to select the proper tests for the population or the goal of the athletes. The unit will show students how to properly administer a test and why it is important to be diligent when testing.

**Key Terms:** concurrent validity, construct validity, content validity, convergent validity, criterion-referenced validity, discriminant validity, evaluation, face validity, field test, formative evaluation, interrater agreement, interrater reliability, intrasubject variability, measurement, midtest, objectivity, posttest, predictive validity, pretest, reliability, test, test battery, test-related reliability, typical error of measurement, validity

**Learning Objectives:**

- Identify and explain reasons for performing tests.
- Understand testing terminology to communicate clearly with athletes and colleagues.
- Evaluate a test's validity and reliability.
- Recognize when to select the appropriate tests.
- Ability to administer test protocols properly and safely.

**Activities:** Students will learn how to use the Functional Movement Screen (FMS) in order to evaluate client readiness for training. Students will have a partner and take them through the FMS and score them on movement quality. Students will then give the partner their score and give them their training recommendations.

## **Unit 15 –Warm Up and Flexibility Training**

**Unit Summary:** The unit will introduce how to properly create a warm-up to prepare athletes for the training or competition and potentially reduce the likelihood of injury. The unit will give the students a structure to best organize the warm-up to be as effective as possible. Students will learn methods and techniques in order to improve range of motion that can best facilitate movement.

**Key Terms:** active stretch, agonist contraction, autogenic inhibition, ball and socket joint, ballistic stretch, contract-relax, dynamic flexibility, dynamic stretch, elasticity, ellipsoidal joint, fibrosis, flexibility, general warm-up, Golgo tendon organ (GTO), hinge joint, hold-relax, hold-relax with agonist contraction, mechanoreceptor, mobility drills, muscle spindles, passive stretch, plasticity, potentiation, proprioceptive neuromuscular facilitation (PNF), Raise, Activate and Mobilize, and Potentiate (RAMP), range of motion (ROM), reciprocal inhibition, specific warm-up, static flexibility, static stretch, stretch reflex

**Learning Objectives:**

- Identify the components and benefits of a pre exercise warm-up.
- Develop structured effective warm-ups.
- Identify the factors that affect flexibility.
- Understand when to use flexibility exercises that take advantage of proprioceptive neuromuscular facilitation.
- Select and apply appropriate static and dynamic stretching methods.

**Activities:** Students will create a dynamic warm-up for a training session. The students must take into consideration the movements of the day in the training session as well as the needs of the population taking part in the training session. The warm-up must cover the RAMP protocol.

## **Unit 16 – Resistance Training Technique and Execution**

**Unit Summary:** In this unit, students will understand the general techniques involved in properly performing training exercises. Students will be shown how to teach proper training exercise and spotting techniques. Students will learn how to assess movement and provide the proper cues in order to improve movement technique.

**Key Terms:** neutral grip, neutral spine, pronated grip, range of motion (ROM), supinated grip, structural exercises, valsalva maneuver

### **Learning Objectives:**

- Describe the goal of the movement.
- Explain the proper technique of the movement.
- Identify if the technique of the movement is acceptable.
- Identify and describe the proper technique if the movement is performed poorly.

**Activities:** Students will present on the technique of 1 of 6 basic movements: squat, push up, chin up, hip hinge, lunge, or plank. Students will provide the goal of the exercise, the proper technique and how to correct poorly performed movements.

## **Unit 17 –Program Design for Resistance Training**

**Unit Summary:** The unit will introduce the student on how to properly coordinate training variables in order to achieve the desired goals. Students will learn how to properly determine the exercises that are needed, as well as the ideal volume and intensity. Being able to determine such factors will allow the students to adhere to the performance goals of the athlete.

**Key Terms:** 1-repetition maximum (1RM), 2-for-2 rule, agonist, antagonist, assistance exercise, circuit training, compound set, core exercise, exercise history, exercise order, exercise selection, exercise technique experience, goal repetitions, injury analysis, intensity, interest rest, load, mechanical work, movement analysis, multi joint exercise, muscle balance, needs analysis, overload, physiological analysis, power exercise, profile, program design, progression, recovery exercise, repetition, repetition maximum (RM), repetition-volume, rest period, SAID, set, single joint exercise, specificity, split routine, structural exercise, superset, training background, training frequency, training status, volume, volume-load

### **Learning Objectives:**

- Evaluate the requirements and characteristics of a sport and assess an athlete for the purpose of designing a resistance training program.

- Select exercises based on type, sport specificity, technique experience, equipment availability, and time availability.
- Determine training frequency based on training status, sport season, load, exercise type, and other concurrent exercise.
- Arrange exercises in a training session according to their type.
- Determine 1-repetition maximum (1RM), predicted 1RM from a multiple RM, and RM loads.
- Assign load and repetitions based on the training goal.
- Recognize when and by how much an exercise load should be increased.
- Assign training volumes according to the athlete's training status and the training goal.
- Determine rest period lengths based on the training goal.

**Activities:** Students will be assigned a team sport and be given an injury report along with the team goals provided by the head coach. The students will then create a 4 week offseason program in which they will address the needs of the sport, the goals of the head coach, as well as taking the previous years injury report into consideration. Students will have to defend their exercise selection.

## **Unit 18 –Program Design and Technique for Plyometric Training**

**Unit Summary:** The unit will introduce plyometrics, a type of training that enables athlete's muscles to reach maximum force in short time periods. Students will learn how to best use plyometrics by understanding what is occurring at a physiological level, understanding the principles of program design, and how to safely integrate plyometrics into a training program. Plyometrics can create great results, with proper management students will be able to create effective programs of their own.

**Key Terms:** amortization phase, balance, bound, box drill, complex training, concentric phase, depth jump, eccentric phase, jumps in place, multiple hops and jumps, muscle spindles, potentiation, power, push-up, series elastic component (SEC), standing jump, stretch reflex, stretch-shortening cycle (SSC), throw

### **Learning Objectives:**

- Explain the physiology of plyometric exercise.
- Identify the phases of the stretch-shortening cycle.
- Identify the components of a plyometric training program.
- Design a safe and effective plyometric training program.
- Recommend proper equipment for use during plyometric exercise.
- Teach correct execution of lower and upper plyometric exercises.

**Activities:** Students will create a plyometric program that compliments the previous 4 week offseason training program in the last unit. Students will have to defend why they chose the exercises and how they are a compliment to the training session.

## **Unit 19 –Program Design and Technique for Speed and Agility**

**Unit Summary:** This unit will introduce the students to one of the more important aspects of training. Students will learn how to properly choose exercises that have the best carry over for the sport in mind. Students will learn to assess physical capabilities in order to understand the needs of the sport and how to properly address them. Students will dive back into biomechanics as it will provide guidance in proper selection of exercises and drills.

**Key Terms:** acceleration, agility, change of direction, complex training, force, ground preparation, impulse, momentum, periodization, postactivation potentiation, rate of force development (RFD), recovery, speed, spring-mass model (SMM), sprinting, strength, stretch-shortening cycle (SSC), velocity

### **Learning Objectives:**

- Describe the underlying biomechanical constructs of sprint, change-of-direction, and agility performance.
- Apply sound movement principles to the coaching of locomotion modes and techniques.
- Analyze the abilities and skills needed to perform specific movement tasks.
- Effectively monitor the development of sprint, change-of-direction, and agility.
- Design and implement training programs to maximize athletic performance.

**Activities:** Students will continue to add their existing training program. The students will study the sport they programmed in order to best adapt sprint, change-of-direction, and agility drills. Students will have to defend their choices and best apply the drills to the already existing resistance training and plyometrics.

## **Unit 20 –Program Design and Technique for Aerobic Endurance Training**

**Unit Summary:** The unit will introduce the students to the general principles of aerobic endurance training that will allow them to create a safe and effective program. Students will revisit bioenergetics in order to review the physiology of aerobic endurance training. The students will learn how aerobic endurance training can be an effective tool, even if the sport is primarily anaerobic.

**Key Terms:** age-predicted maximal heart rate (APMHR), altitude, base training, cross-training, detraining, duration, exercise economy, Fartlek training, frequency, functional capacity, heart rate reserve (HRR), high-intensity interval training, inseason, intensity, interval training, Karvonen method, lactate threshold, long slow distance training (LSD) maximal aerobic capacity (VO<sub>2</sub> max), maximal lactate steady state, metabolic equivalent (MET), mode, offseason, overload,

pace/tempo training, percentage of maximal heart rate (MHR) method, postseason, preseason, ratings of perceived exertion (RPE), recovery, resistance training, tapering

### **Learning Objectives:**

- Discuss the factors related to aerobic endurance performance.
- Select the model of aerobic endurance training.
- Set aerobic endurance training frequency based on training status, sport season, and recovery requirements.
- Assign aerobic endurance training duration and understand the various methods used to monitor intensity.
- Describe the various types of aerobic endurance training programs.
- Apply the program design variables based on the sport season.
- Address the issues of cross-training, detraining, tapering, supplemental resistance training, and altitude when designing an aerobic endurance training program.

**Activities:** The students will apply aerobic endurance training to their existing 4 week offseason plan. Students will now be tasked with properly fitting the new component as the program already has multiple training implementations. Students will have to potentially remove training protocols in order to make room for new ones. Students will have to think critically of which are the important protocols that need to be addressed, and which may not be as important as they once believed them to be.

## **Unit 21 –Periodization**

**Unit Summary:** The unit will introduce the students how to manage training loads and work with the team calendar and schedule. Such methods will allow the students to create programs that are able to express physiological attributes at key moments of the team calendar year. Such organization will teach students how to manage loads in order to reduce overtraining and apply the best stimulus possible. A history of periodization will be introduced to show students the progressions that have taken place over time and the methods that are currently being used.

**Key Terms:** active rest, annual training plan, basic strength phase, competitive period, daily undulating periodization, first transition period, fitness-fatigue paradigm, General Adaptation Syndrome (GAS), general preparatory phase, hypertrophy/strength endurance phase, linear periodization, macrocycle, maintenance, mesocycle, microcycle, nonlinear periodization, peaking, periodization, preparatory period, recovery, restoration, second transition period, specific preparatory phase, stimulus-fatigue-recovery-adaptation theory, supercompensation, traditional periodization

### **Learning Objectives:**

- Understand the central concepts that underpin the periodization of training.
- Appreciate the value, role and application of periodization in strength and conditioning programs.

- Describe the four periods of the traditional periodization model.
- Describe the two phases of the preparatory period of the traditional periodization model.
- Relate the four sport seasons to the four periods of the traditional periodization model.
- Apply the program design variables to create a periodized strength training program.

**Activities:** The students will create a 26 week offseason and preseason macrocycle for the sport they were previously working on. They will have to take into consideration the school academic calendar and work around periods in which they will not be in contact with athletes. The students will have to justify their choices and application of methods.

## **Unit 22 –Rehabilitation and Conditioning**

**Unit Summary:** In this unit, students will learn about the sports medicine team that may be provided to them and the role they may play in rehabilitation. The strength and conditioning professional has a key role in the back end of the rehabilitation process, it is vital to understand the capabilities and responsibilities one must have when working with an athlete. Students will be introduced to different types of injuries and the healing process that is essential for recovery.

**Key Terms:** athletic trainer, closed kinetic chain, contraindication, contusion, counselor, daily adjustable progressive resistive exercise (DAPRE), dislocation, edema, exercise physiologist, fibroblastic repair, indication, inflammation, inflammatory response, macrotrauma, maturation-remodeling, microtrauma, neuromuscular control, nutritionist, open kinetic chain, physical agent, physical therapist, physiotherapist, proprioception, psychiatrist, psychologist, remodeling, repair, sprain, strain, strength and conditioning professional, subluxation, team physician, tendinitis

### **Learning Objectives:**

- Identify the members of the sports medicine team and their responsibilities during rehabilitation and reconditioning of injured athletes.
- Recognize the types of injuries athletes sustain.
- Comprehend the timing and events of each tissue healing phase.
- Describe the role of the strength and conditioning professional during injury rehabilitation and conditioning.

**Activities:** Students will select a medical profession with emphasis in sports medicine to research. They will develop an oral and visual presentation including the history, scope of career opportunities available, professional associations, education requirements, field experience, certifications, and licensure.