

Arizona Peace Officer Standards and Training

Basic Curriculum Lesson Plan

LESSON TITLE: PHYSICAL FITNESS - ANATOMICAL KINESIOLOGY 8.3

SUBJECT: Section 9

AZ POST DESIGNATION: 8.3.9

HOURS: 2

INSTRUCTOR TO STUDENT RATIO:

COURSE CONTENT: The basic study of the structure and function of the muscular and skeletal systems of the human body. This is necessary to develop and implement a successful physical fitness program for all types of individuals.

PERFORMANCE OBJECTIVES: Upon completion of this course of instruction, students using notes, handouts and other support materials as references, within the allotted time, will be able to:

- 8.3.9.1. Define anatomy, kinesiology and physiology.
- 8.3.9.2. Identify and define the fundamental movements of the human body.
- 8.3.9.3. Identify the functions of the skeletal system.
- 8.3.9.4. Identify the bones of the skeletal system.
- 8.3.9.5. Define the types of muscle contraction.
- 8.3.9.6. Identify and explain the functions of muscles used in exercise.

DATE FIRST PREPARED: August 1997
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AZ POST – APPROVAL: Richard Watling DATE: June 2004
AZ POST – APPROVAL: Lori Wait DATE: April 2022

LIST ANY PREREQUISITES:

LEAD INSTRUCTOR:

BACK-UP INSTRUCTOR(S):

INSTRUCTOR REFERENCES: Physical Fitness Specialist Course Manual compiled by the Cooper Institute of Aerobic Research, Dallas, Texas. Revised 1996.

CLASS LEVEL: Instructor

TRAINING AIDS: Computer-aided slides on PowerPoint software.

INSTRUCTIONAL STRATEGY: Instructional objectives will be obtained through the use of lecture, reading assignments, instructor demonstration and group participation.

SUCCESS CRITERIA: Success in this functional area will be demonstrated through the attainment of a 70% passing grade on a written objective examination comprised of multiple choice and true/false questions.

COMPUTER FILE NAME: 8.3.9 Sec 9 Anatomical Kinesiology

DATE RELEASED TO THE SHARE FILE: May 27, 2022

I. INTRODUCTION

- A. Instructor(s) – (self) introduction.
- B. Preview of performance objectives.

II. DEFINITIONS

- A. Anatomy – the study of structure.
- B. Physiology – the study of function.
- C. Kinesiology – the study of structure and function of the musculo-skeletal system; the science of human movement.
- D. Biomechanics – the in-depth study of the mechanical aspects of kinesiology.

III. THE SKELETAL SYSTEM

- A. Function.
 - 1. Protection.
 - 2. Support.
 - 3. Red blood cell production.
 - 4. Reservoir.
 - 5. Provides attachments.
- B. Skeletal structure (206 bones total).
 - 1. Axial (80 bones).
 - a. Head.
 - b. Neck.
 - c. Thorax.
 - d. Vertebral column.
 - 2. Appendicular (126 bones).

- a. Arms.
 - b. Legs.
 - c. Pelvis.
- C. Vertebral column.
- 1. Cervical (7 bones).
 - 2. Thoracic (12 bones).
 - 3. Lumbar (5 bones).
 - 4. Sacrum (5 bones fused together).
 - 5. Coccyx (4 bones fused together).

IV. PLANES OF MOTION

- A. Sagittal – divides the body into right and left halves.
- B. Frontal – divides the body into front and back halves.
- C. Transverse – divides the body into top and bottom halves.

V. ANATOMICAL DIRECTIONS (Anatomical position - hands are supinated.)

- A. Anterior – front side of the body.
- B. Posterior – back side of the body.
- C. Superior – top end of the body; toward the head.
- D. Inferior – lower end of the body; toward the “tail.”
- E. Proximal – closest to the trunk.
- F. Distal – farthest from the trunk.
- G. Medial – toward the middle of the body.
- H. Lateral – away from the middle of the body.

VI. MOVEMENT

- A. Flexion – decreases the angle of the joint.
- B. Extension – increases the angle of the joint.
- C. Hyperextension – past the normal range of extension.
- D. Adduction – limb moves toward the middle of the body.
- E. Abduction – limb moves away from the body.
- F. Rotation – rotary or turning of a part.
- G. Circumduction – circular or conical movement of a part.
- H. Pronation – palms turned down.
- I. Supination – palms turned up.
- J. Elevation – lifting or moving to a superior position.
- K. Depression – lowering or moving to an inferior position.
- L. Inversion – supination of the foot.
- M. Eversion – pronation of the foot.
- N. Dorsi flexion – lifting the toes of the foot up.
- O. Plantar flexion – pointing the toes of the foot down.

VII. MUSCULO-SKELETAL SYSTEM

- A. Three (3) types of muscles:
 - 1. Skeletal.
 - 2. Smooth.
 - 3. Cardiac.
- B. Causes of joint movement:
 - 1. Muscle contraction – muscles always pull.

2. Gravity.
- C. Muscular attachments:
1. Tendons – attach muscle to bone.
 2. Origin – attachment usually at the proximal end.
 3. Insertion – attachment usually to the distal end.
- D. Muscle composition.
1. Three (3) components.
 - a. Seventy-five percent (75%) water.
 - b. Twenty percent (20%) protein. (Explain sliding filament theory.)
 - i. Actin – the thin protein.
 - ii. Myosin – the thick protein.
 - c. Five percent (5%) inorganic salts and other stuff.
- E. Properties of muscle:
1. Excitability (or irritability) – the ability to receive and respond to a stimulus.
 2. Contractility (or contractility) – the ability to contract or shorten from the resting length.
 3. Extensibility (or distensibility) – the ability of a muscle to “stretch” or be taken past its normal resting length.
 4. Elasticity – the ability of a muscle to return from a stretch to its resting length.
- F. Types of muscular contraction:
1. Isotonic (or dynamic) – the muscles shorten or lengthen.
 - a. Concentric – muscle contracts and shortens.
 - b. Eccentric – muscle is contracting but lengthens. (Explain delayed onset muscle soreness.)

2. Isometric (or static) – force is developed without movement.
- G. Muscle symmetry.
1. Principle of opposition – exercising paired muscles.
 2. Paired muscles are found on opposite sides of the joint and have opposing functions.
 3. Important in developing sound biomechanics.
- H. Roles of muscles:
1. Agonist – the primary mover.
 2. Antagonist – the opposing muscle.
 3. Stabilizers – hold or fix a joint during movement.
 4. Neutralizers – prevent unwanted actions through contraction.
- I. Muscular force.
1. Principle of pre-tension – when the muscle is stretched to its limit it provides the greatest anatomical force.
 2. Principle of angle pull – the greatest amount of force can be delivered if the point of attachment is at a right angle to the lever that it is moving.
 3. All or none law – a muscle fiber will contract to 100% or its ability or it will not contract at all. Strength training develops the ability to recruit more motor units for maximal contraction.
 4. Size – a larger muscle fiber has a potential for greater force than a small muscle fiber.
 5. Location – the origin and insertion of muscle attachment will determine the amount of force potential.
- J. Bi-articulate muscles – two (2) joint muscles that cross more than one (1) joint and can produce movement around either joint.
- K. Guidelines to sound biomechanics:
1. The neck must remain neutral.
 2. The spine must remain neutral.

3. Lift the chest comfortably and naturally adduct shoulder blades.
4. Weight-bearing segments should be properly aligned.
5. Extension of the weight bearing joints should be easy, not strained, tense or rigid.
6. Toes and patellae should point straight forward; knees should be over toes and flexed for support.

VIII. MUSCLES AND THEIR FUNCTIONS

A. The elbow and shoulder.

1. Pectoralis Major – the chest muscles.
 - a. Adducts the humerus.
 - b. Developmental exercises – push-ups, bench press, flys, etc.
2. Rhomboids – upper back.
 - a. Adducts the scapula.
 - b. Developmental exercises – reverse flys, cable rows, etc.
3. Trapezius – “traps”; upper back.
 - a. adducts and rotates the scapula upward.
 - b. Developmental exercises – shoulder shrugs, reverse flys, etc.
4. Deltoid – shoulder (anterior, posterior, medial).
 - a. Anterior – flexes and horizontally adducts the humerus.
 - b. Posterior – extends and horizontally abducts the humerus.
 - c. Medial – abducts the humerus.
 - d. Developmental exercises – military press, incline and flat bench press, rear delt raises, flys, rowing, etc.
5. Latissimus Dorsi – middle and lower back.

- a. Adducts the humerus.
- b. Developmental exercises – wide grip pull ups and lat pull downs.
6. Biceps Brachii – anterior of the upper arm.
 - a. Flexes the elbow.
 - b. Developmental exercises – curls, pull-up, chin-ups, etc.
7. Triceps Brachii – posterior of upper arm.
 - a. Extends the elbow.
 - b. Developmental exercises – bench press, dips, triceps extensions, push-ups, etc.
- B. The trunk and hip:
 1. Rectus Abdominis – the entire length of the stomach.
 - a. Flexes and laterally flexes the spine.
 - b. Developmental exercises – sit-ups and crunches.
 2. Transverse Abdominis – (lays horizontally behind the rectus abdominis).
 - a. No action in lateral trunk flexion; acts like a girdle to flatten abdominal wall and assists in expiration.
 - b. Obliques – (external and internal) wraps around the trunk.
 - c. External – runs downward and medially.
 - d. Internal – runs upward and medially.
 - e. Flexes and rotates the spine.
 - f. Developmental exercises – side bends and knee-to-elbow sit ups.
 3. Erector Spinae – consists of the iliocostalis, longissimus, and spinalis.
 - a. Extends and hyper-extends the spine.
 - b. Developmental exercises – back extensions, “good mornings.”

4. Iliopsoas – crosses hip primarily spanning the lumbar region.
 - a. Flexes hip.
 - b. Developmental exercises – full bent knee sit-ups, running, walking, etc.
 5. Gluteus Maximus – buttocks.
 - a. Extends and hyper-extends hips.
 - b. Developmental exercises – hip extension, half squat, leg press, etc.
- C. The knee and ankle:
1. Rectus Femoris – front of thigh.
 - a. Flexes hip and extends knee.
 - b. Developmental exercises – running, knee extension and leg press.
 2. Vastus Intermedius – front of thigh (middle, underneath femoris).
 - a. Extends knee.
 - b. Developmental exercises – squats, knee extension and leg press.
 3. Vastus Lateralis – front of thigh (lateral).
 - a. Extends knee.
 - b. Developmental exercises – squats, knee extension and leg press.
 4. Vastus Medialis – front of thigh (medial).
 - a. Extends knee.
 - b. Developmental exercises – squats, knee extension and leg press.
 5. Biceps Femoris – back of thigh (lateral).
 - a. Extends and hyper-extends the hip and flexes the knee.
 - b. Developmental exercises – running and leg curls.
 6. Semitendinosus – back of thigh (middle).

- a. Extends and hyper-extends the hip and flexes the knee.
- b. Developmental exercises – running and leg curls.
- 7. Semimembranosus – back of thigh (medial).
 - a. Extends and hyper-extends the hip and flexes the knee.
 - b. Developmental exercises – running and leg curls.
- 8. Gastrocnemius – outer-calf muscle.
 - a. Plantar flexion of the ankle and assists in knee flexion.
 - b. Developmental exercise – running, jumping, heel raises, etc.
- 9. Soleus – inner-calf muscle.
 - a. Plantar flexion of the ankle.
 - b. Developmental exercise – running, jumping, heel raises, etc.
- 10. Tibialis Anterior – muscle of the shin.
 - a. Dorsi flexion of the ankle.
 - b. Developmental exercises – walking, running, jumping, toe raises, etc.

IX. CONCLUSION

- A. Review of performance objectives.
- B. Final questions and answers.
- C. Instructor closing comment(s).