



Anatomy & Physiology Course Objectives

Effective Date: January 1, 2021; Implementation Date: July 1, 2021

The Anatomy and Physiology course objectives may be met through a separate course offering or in conjunction with the Paramedic program and incorporated into the lesson plan.

The instructor must meet the **Southern Association of Colleges and Schools Commission on Colleges (SACSCOC)** requirements for instructors of credit-bearing Anatomy and Physiology courses, regardless of whether the instruction is part of a curriculum, continuing education, or extension program.

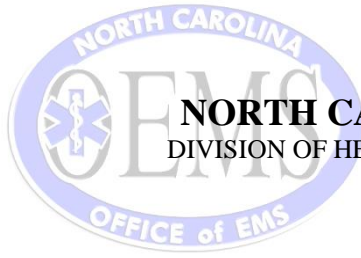
The North Carolina Office of Emergency Medical Services has determined that some North Carolina Community College System (NCCCS) course offerings will meet or exceed the requirements as listed within the Anatomy and Physiology Course Objectives. Acceptable NCCCS equivalents are as follows:

- **EMS-3163 Basic Anatomy and Physiology**
 - When the course meets all other requirements of these guidelines, to include meeting SACSCOC standards for instructors of curriculum-level courses
- **BIO 163 Basic Anatomy and Physiology**
- **BIO 165 & BIO 166 Anatomy and Physiology I & II** (must complete both sections)
- **BIO 168 & BIO 169 Anatomy and Physiology I & II** (must complete both sections)

*****EMS-3000 courses completing prior to 7/1/2021 will be accepted through 1/1/2022*****

*****EMS-3000 courses completing on or after 7/1/2021 will not be accepted*****

Minimum Program Length= 96 hours, which must include 32 hours of lab



NORTH CAROLINA OFFICE OF EMERGENCY MEDICAL SERVICES
DIVISION OF HEALTH SERVICE REGULATION • DEPARTMENT OF HEALTH AND HUMAN SERVICES

Anatomy & Physiology Course Objectives

The intent of these educational objectives are to integrate a complex depth and comprehensive breadth of knowledge of the anatomy and physiology of all human systems.

OBJECTIVES:

I. Anatomical Terms

- A. Anatomy
- B. Physiology
- C. Pathophysiology
- D. Homeostasis
- E. Specific body parts and areas
 - 1. Axillary
 - 2. Brachial
 - 3. Buccal
 - 4. Cardiac
 - 5. Cervical
 - 6. Cranial
 - 7. Cutaneous
 - 8. Deltoid
 - 9. Femoral
 - 10. Gastric
 - 11. Gluteal
 - 12. Hepatic
 - 13. Inguinal
 - 14. Lumbar
 - 15. Mammary
 - 16. Nasal
 - 17. Occipital
 - 18. Orbital
 - 19. Parietal
 - 20. Patellar
 - 21. Pectoral
 - 22. Perineal
 - 23. Plantar
 - 24. Popliteal
 - 25. Pulmonary
 - 26. Renal
 - 27. Sacral
 - 28. Temporal
 - 29. Umbilical
 - 30. Volar

II. Planes and sections of the body

- A. Frontal (coronal) Plane
- B. Sagittal Plane
- C. Midsagittal Plane
- D. Transverse Plane
- E. Cross-Section
- F. Longitudinal Section

III. Anatomical Topography

- A. Abdominal Quadrants and Regions
 - 1. Abdominal quadrants
 - a. Right upper quadrant (RUQ)
 - b. Left upper quadrant (LUQ)
 - c. Right lower quadrant (RLQ)
 - d. Left lower quadrant (LLQ)
 - 2. Abdominal regions
 - a. Right hypochondriac
 - b. Epigastric
 - c. Left hypochondriac
 - d. Right lumbar
 - e. Umbilical
 - f. Left lumbar
 - g. Right iliac
 - h. Hypogastric
 - i. Left iliac

IV. Organ Systems

- A. Skeletal
- B. Muscular
- C. Respiratory
- D. Circulatory
- E. Nervous
- F. Integumentary
- G. Digestive
- H. Endocrine
- I. Renal
- J. Reproductive
- K. Lymphatic System and Immune System

V. Anatomic Cavities

- A. Dorsal
 - 1. Cranial cavity
 - 2. Spinal cavity
- B. Ventral
 - 1. Thoracic cavity
 - 2. Abdominal cavity
 - 3. Pelvic cavity

VI. Organization

- A. Atomic Level
 - 1. Matter,
 - 2. Element
 - 3. Atom
 - 4. Proton
 - 5. Neutron
 - 6. Electron
 - 7. Bonding
 - a. Ionic
 - b. Covalent
 - c. Hydrogen bonds
 - 8. Chemical reactions
 - a. Synthesis
 - b. Decomposition
- B. Chemical Level
 - 1. Carbohydrates
 - a. Monosaccharides
 - b. Disaccharides
 - c. Oligosaccharides
 - d. Polysaccharides
 - e. Starches
 - f. Glycogen
 - g. Cellulose
 - h. Fiber
 - 2. Lipids
 - a. True fats
 - b. Triglycerides
 - c. Phospholipids
 - d. Steroids
 - 3. Proteins
 - a. Amino acids
 - b. Peptide bonds
 - c. Polypeptide
 - 4. Enzymes -- Active Site Theory
 - 5. Nucleic acids
 - a. DNA
 - b. RNA
 - c. ATP
 - 6. Trace Elements

VII. Cell Structure and Function

- A. Cell Theory
- B. Cellular Anatomy and Physiology
 - 1. Cell membrane
 - 2. Cytoplasm

3. Nucleus and chromosomes
4. Organelles
 - a. Mitochondria
 - b. Lysosomes
 - c. Golgi apparatus
 - d. Ribosomes
 - e. Endoplasmic reticulum
- C. Cellular Respiration
 1. Aerobic
 2. Anaerobic
- D. Cellular Environment
 1. Water compartments
 - a. Intracellular (ICF)
 - b. Extracellular (ECF)
 - i. plasma
 - ii. lymph
 - iii. interstitial fluid
 - iv. specialized fluids
 - a) synovial
 - b) cerebrospinal
 - c) aqueous humor
 2. Isotonic
 3. Hypotonic
 4. Hypertonic
 5. Acid and base
 - a. pH scale
 - i. Base
 - ii. Acid
 - b. Normal pH ranges of body fluids
 - c. Buffer system
- E. Cellular Transport Mechanisms
 1. Diffusion
 2. Osmosis
 3. Facilitated diffusion
 4. Active transport
 5. Filtration
 6. Phagocytosis
 7. Pinocytosis
- F. Cell Division
 1. Mitosis
 2. Meiosis
 - a. Genetic code
 - b. Protein synthesis

- c. Differentiation
- d. DNA fingerprinting
- 3. Mutations

VIII. Tissue Level of Organization and Membranes

- A. Epithelial tissue
 - 1. Simple squamous
 - 2. Stratified squamous
 - 3. Transitional
 - 4. Simple cuboidal
 - 5. Simple columnar
 - 6. Ciliated
- B. Connective tissue
 - 1. Blood
 - 2. Areolar
 - 3. Adipose
 - 4. Fibrous
 - 5. Elastic
 - 6. Bone
 - 7. Cartilage
- C. Muscle tissue
 - 1. Smooth
 - 2. Skeletal
 - 3. Cardiac
- D. Neural tissue
- E. Membranes
 - 1. Pleura
 - 2. Pericardial
 - 3. Peritoneum-mesentery
 - 4. Specialized connective tissue
 - a. Superficial fascia
 - b. Periosteum
 - c. Perichondrium
 - d. Synovial
 - e. Deep fascia
 - f. Meningies
 - g. Fibrous pericardium

IX. Skeletal System

- A. Functions
- B. Classification of bones
 - 1. Long bones
 - a. Diaphysis
 - b. Epiphysis
 - c. Marrow canal
 - d. Yellow bone marrow

2. Short bones
3. Flat bones
4. Irregular bones
5. Joint surfaces
 - a. Articular cartilage
 - b. Periosteum
- C. Embryonic skeleton maturation
 1. Bone matrix
 2. Osteoblasts
 3. Ossification – the production of bone matrix
 4. Fontanel
 5. Epiphyseal discs
 6. Osteoclasts
 7. Marrow canal
- D. Bone growth and maintenance
 1. Heredity
 2. Nutrition
 3. Hormones
 4. Exercise – stress
- E. Hormones involved in bone growth and maintenance
 1. Growth Hormone
 2. Thyroxine
 3. Insulin
 4. Parathyroid hormone
 5. Calcitonin
 6. Estrogen
 7. Testosterone
- F. Major subdivision of the skeleton
 1. Axial skeleton
 2. Appendicular skeleton
- G. Components
 1. Skull
 - a. Cranial bones
 - i. frontal
 - ii. temporal
 - iii. occipital
 - iv. sphenoid
 - v. ethmoid
 - b. Sutures
 - c. Facial bones
 - i. mandible
 - ii. condyloid joint
 - iii. maxillae
 - d. Paranasal sinuses and ciliated epithelium
 - e. Mastoid sinuses

- f. Auditory bones
- 2. Vertebral column
 - a. Vertebrae
 - b. Cervical vertebrae
 - i. atlas
 - ii. pivot joint
 - iii. axis
 - c. Thoracic vertebrae
 - d. Lumbar vertebrae
 - e. Sacrum
 - f. Sacroiliac joints
 - g. Coccyx
- 3. Vertebral canal
 - a. Discs
 - b. Symphysis joints
- 4. Rib cage
 - a. 12 pairs of ribs
 - b. Sternum
 - c. Manubrium
 - d. Body
 - e. Xiphoid process
 - f. True ribs
 - g. False ribs
 - h. Floating ribs
- 5. Shoulder and Arm
 - a. Scapula
 - b. Clavicle
 - c. Humerus
 - d. Radius
 - e. Ulna
 - f. Carpals
 - g. Metacarpals
 - h. Phalanges
- 6. Hip and Leg
 - a. Hip bones
 - b. Ilium
 - c. Ischium
 - d. Pubis
 - e. Pubic bones
 - f. Pubic symphysis
 - g. Acetabulum
 - h. Femur
 - i. Patella

- j. Tibia
 - k. Fibula
 - l. Tarsals
 - m. Calcaneus
 - n. Talus
 - o. Metatarsals
 - p. Phalanges
- H. Classification of Joints
 - 1. Synarthrosis (immovable)
 - 2. Amphiarthrosis (slightly movable)
 - 3. Diarthrosis (freely movable)
- I. Types of Joints
 - 1. Gliding joints
 - 2. Hinge joints
 - 3. Pivot joints
 - 4. Ball and socket joints
 - 5. Saddle joints
 - 6. Symphysis
- J. Synovial Joints
 - 1. Articular cartilage
 - 2. Joint capsule
 - 3. Synovial membrane
 - 4. Synovial fluid
 - 5. Bursae

X. Muscular System

- A. Gross Anatomy
 - 1. Muscle fibers
 - 2. Tendons
 - 3. Fascia
 - 4. Periosteum
 - 5. Origin
 - 6. Insertion
- B. Microscopic Anatomy
 - 1. Myofibrils
 - 2. Myosin
 - 3. Actin
 - 4. Titin
 - 5. Troponin
 - 6. Tropomyosin
 - 7. Sarcoplasmic reticulum
- C. Actions of Muscles
 - 1. Flexion
 - 2. Extension

3. Adduction
 4. Abduction
 5. Pronation
 6. Supination
 7. Dorsiflexion
 8. Plantar flexion
 9. Rotation
- D. Contraction of a Skeletal Muscle Fiber
1. Nerve Impulse
 - a. Polarization
 - b. Depolarization
 - c. Repolarization
 - d. Action potential
 2. Neuromuscular junction and functions
 - a. Axon terminal
 - b. Synapse
 3. Structure of the sarcomere
 4. Sliding filament theory of muscle contraction and function
 - a. Acetylcholine
 - b. Calcium ions
 - c. Myosin and actin
 - d. Troponin and tropomyosin
 - e. Cholinesterase
 5. Energy sources for muscle contraction
 - a. ATP
 - b. Creatinine phosphate
 - c. Creatinine
 - d. Glycogen
 - e. Glucose
 6. Hemoglobin, myoglobin, oxygen debt, lactic acid, and recovery oxygen uptake
 7. Aerobic and anaerobic endurance and the relationship to muscle movement
- E. Major Muscles of the Body
1. Antagonistic
 2. Synergistic

XI. Respiratory System

- A. General Function of the Respiratory System
1. Upper respiratory tract
 2. Lower respiratory tract
- B. Structure and Functions of the Nasal Cavities and Pharynx
1. Nasal cavities
 - a. Nose
 - b. Nasal cavities

- c. Nasal septum
 - d. Nasal mucosa
 - e. Olfactory receptors
 - f. Paranasal sinuses
 - 2. Pharynx
 - a. Nasopharynx
 - b. Soft palate
 - c. Oropharynx
 - d. Laryngopharynx
- C. Structure and Function of the Larynx and the Speaking Mechanism
 - 1. Voice box
 - 2. Thyroid cartilage
 - 3. Epiglottis
 - 4. Vocal cords
 - 5. Glottis
- D. Structure and Functions of the Trachea and Bronchial Tree
 - 1. Trachea
 - 2. Primary bronchi
 - 3. Bronchial tree
 - 4. Right and left main-stem bronchi
 - 5. Bronchioles
- E. Lungs
 - 1. Location and function
 - 2. Pleural membranes
 - a. Parietal pleura
 - b. Visceral pleura
 - c. serous fluid
 - 3. Hilus
- F. Structure and Function of the Alveoli and Pulmonary Capillaries
 - 1. Surfactant
- G. Mechanism of Breathing
 - 1. Mechanical ventilation
 - a. Mechanism of inhalation
 - i. Inspiration
 - ii. phrenic nerve
 - iii. intercostal nerves
 - iv. respiration
 - v. ventilation/perfusion disturbance
 - vi. diaphragm
 - vii. external intercostal muscles
 - viii. internal intercostal muscles
 - ix. pressures
 - b. Changes in air pressure that occur within the thoracic cavity during respiration
 - iv. atmospheric

- v. intrapleural
 - vi. intrapulmonic
 - c. Role of the visceral and parietal pleura in respiration
 - d. Mechanics of exhalation
- H. Explain the Diffusion of Gases in External and Internal Respiration
- I. Discuss Pulmonary Volumes
 - 1. Tidal volume
 - 2. Minute respiratory volume (MRV)
 - 3. Inspiratory reserve volume
 - 4. Expiratory reserve volume
 - 5. Vital capacity
 - 6. Residual air volume
- J. Physiological Dead Space and Lung Compliance
- K. Oxygen and Carbon Dioxide Transport in the Blood
- L. Nervous and Chemical Mechanisms That Regulate Respiration
- M. Respiration Affect on pH of Certain Body Fluids
- N. Respiration and Acid-Base Balance
 - 1. Respiratory acidosis and alkalosis
 - 2. Metabolic acidosis and alkalosis

XII. Circulatory

- A. Blood
 - 1. Composition and function of blood
 - 2. Composition and function of blood plasma
 - a. Amount
 - b. Color
 - c. pH
 - d. Viscosity
 - e. Plasma
 - i. plasma proteins
 - ii. prothrombin
 - iii. fibrinogen
 - iv. albumin
 - v. globulins
 - 3. Primary hemopoietic tissue
 - 4. Function of red blood cells
 - 5. Nutrients necessary for red blood cell production
 - 6. Function of the following
 - a. Stem cells
 - b. Hemocytoblasts
 - c. Normoblasts
 - d. Reticulocyte
 - e.
 - 7. Red blood cell production in hypoxic state
 - 8. Red blood cell and hemoglobin destruction
 - 9. ABO group and Rh factor blood types
 - 10. Types and function of white blood cells (leukocytes)

- a. Neutrophils
- b. eosinophils
- c. basophils
- d. lymphocytes
- e. monocytes
- 11. Platelets role in hemostasis
 - a. Vascular spasm
 - b. Platelet plugs
 - c. Chemical clotting
- 12. Three stages of chemical blood clotting
- 13. Normal values in a complete blood count
- B. The Heart
 - 1. Location and features of the heart
 - a. Mediastinum
 - b. Pericardial membranes
 - c. Fibrous pericardium
 - d. Parietal pericardium
 - e. Epicardium
 - 2. Chambers of the heart
 - a. Myocardium
 - b. Endocardium
 - c. Right and left atria
 - d. Right and left ventricles
 - 3. Valves of the heart and their function
 - a. Tricuspid valve
 - b. Bicuspid valve (mitral valve)
 - c. Aortic valve
 - d. Pulmonary semilunar valve
 - 4. Cardiac cycle
 - 5. Creation of heart sounds
 - a. Papillary muscles
 - b. Chordae tendinae
 - 6. Coronary arteries
 - a. Coronary circulation
 - 7. Major blood vessels
 - 8. Cardiac conduction pathway and its relationship to a normal electrocardiogram
 - a. Pacemaker cells
 - b. Conduction cells
 - 9. Stroke volume, cardiac output, and Starlings law of the heart
 - 10. Nervous system regulation of the function of the heart
- C. Blood Vessels and Circulation
 - 1. Structure and function of the blood vessels, arteries, veins and capillaries
 - 2. Arterial and venous anastomosis
 - 3. Structure of capillaries
 - 4. Exchange of gases that occurs at the capillary level

5. Mechanism that regulate blood flow through arteries, capillaries, and veins
6. Pathway and purpose of the pulmonary circulation
7. Pathway of the systemic circulation
8. Pathway and purpose of the hepatic portal circulation
9. Fetal circulation
10. Branches of the Aorta and their distributions
11. Major systemic arteries and the parts of the body they nourish
12. Major systemic veins and the parts of the body they drain of blood
13. Hemodynamics
 - a. Blood pressure
 - i. venous return
 - ii. pulse pressure
 - iii. peripheral resistance
 - b. Factors that maintain systemic blood pressure
 - i. heart rate and force of contraction
 - ii. vessel elasticity
 - iii. blood viscosity
 - iv. hormones
 - v. peripheral resistance
 - c. Osmosis
 - d. Diffusion
 - e. Facilitated diffusion
 - f. Active Transport
 - g. Hydrostatic pressure
 - h. Oncotic pressure
14. Regulation of blood pressure by the heart and kidneys
15. Medulla and autonomic nervous system regulation of the diameter of the blood vessels
16. Coordination of the cardiac, vasomotor, and respiratory centers to control blood flow through the tissues

XIII. Nervous System

- A. Basic Components
 1. Neuron
 - a. Axon
 - b. Dendrites
 - c. Myelin sheath
 - d. Neurolemma
 - e. Microglia
 - f. Astrocytes
 - g. Schwann cells
 - h. Neuroglia
 2. Type of neurons
 - a. Sensory

- b. Motor
 - c. Interneurons
 - 3. Nerves and Tracts
 - a. Sensory nerves
 - b. Motor nerves
 - c. Mixed nerve
 - d. Nerve tract (white matter)
 - 4. Nerve Impulse
 - a. Membrane potential and the conduction of an action potential
 - i polarization
 - ii depolarization
 - iii impulse transmission
 - iv iv. salutatory conduction
 - b. Impulse transmission at synapses
- B. Central Nervous System
 - 1. Function of the spinal cord
 - 2. Spinal nerves and function
 - 3. Spinal cord reflexes
 - a. Stretch reflexes
 - b. Reflex arc
 - c. Flexor reflexes
 - 4. Parts of the brain
 - a. Ventricles
 - b. Medulla
 - c. Pons midbrain
 - d. Cerebellum
 - e. Hypothalamus
 - f. Thalamus
 - g. Cerebrum
 - h. Frontal lobes
 - i. Parietal lobes
 - j. Temporal lobes
 - k. Occipital lobes
 - l. Basal ganglia
 - m. Corpus callosum
 - 5. Meninges location and function
 - 6. Function of the blood-brain barrier
 - 7. Location and functions of the cerebrospinal fluid
- C. Peripheral Nervous System
 - 1. Cranial nerves and function
 - a. Olfactory nerves
 - b. Optic nerves
 - c. Oculomotor nerves
 - d. Trochlear nerves
 - e. Trigeminal nerves

- f. Abducens nerves
- g. Facial nerves
- h. Vestibulocochlear nerves
- i. Glossopharyngeal nerves
- j. Vagus nerves
- k. Accessory nerves
- l. Hypoglossal nerves
- 2. Distribution pattern of spinal nerves
- 3. Sensory and motor pathways
 - a. Sensory pathways
 - i. posterior column pathway
 - ii. spinothalamic pathway
 - iii. spinocerebellar pathway
 - b. Motor pathways
 - i. pyramidal system
 - ii. extrapyramidal system
- 4. Sympathetic division of the autonomic nervous system
- 5. Parasympathetic division of the autonomic nervous system
- 6. Effects of the sympathetic and parasympathetic divisions of the ANS on various organs of the body
 - a. Eyes
 - b. Skin
 - c. Cardiovascular system
 - d. Adrenal glands
 - e. Respiratory system
 - f. Digestive system
 - g. Skeletal muscles
 - h. Urinary system
 - i. Reproductive system

D. Sensory Function

- 1. General purposes of sensations
- 2. General sense and the special senses
 - a. General senses
 - i. pain
 - ii. temperature
 - iii. touch, pressure, position
 - iv. chemical detection
 - b. Special senses
 - i. smell
 - ii. taste
 - iii. vision
 - iv. hearing
 - v. balance
- 3. Parts of the sensory pathway and the general functions of each

- a. Receptors
 - b. Sensory neurons
 - c. Sensory tracts
 - d. Sensory areas
4. Characteristics of sensations
- a. Projection
 - i. phantom pain
 - b. Intensity
 - c. Contrast
 - d. Adaptation
 - e. After-image
5. Characteristics of cutaneous senses
- a. Free nerve endings
 - b. Encapsulated nerve endings
 - c. Neuropathy
6. Referred pain
7. Importance of proprioception or muscle sense
8. Pathways for the sense of taste
- a. Taste buds
 - b. Chemoreceptors
 - c. Transmission via the facial and glossopharyngeal nerves
9. Pathways for the sense of Smell
- a. Olfaction chemoreceptors
 - b. Olfactory cranial nerves
10. Sensation of hunger and thirst
- a. Visceral sensations
 - b. Hypothalamus receptors
 - c. Water to salt proportion
11. Components of the eye and function
- a. Vision receptors
 - b. Refracting system
 - c. Eyelids
 - d. Lacrimal apparatus
 - e. Conjunctiva
 - i. conjunctivitis
 - f. Lacrimal glands
 - i. tears
 - ii. lysozyme enzyme
 - g. Lacrimal sac
 - h. Nasolacrimal duct
 - i. Eyeball
 - i. orbit
 - ii. extrinsic muscles
 - iii. layers of the eyeball

- a) sclera
 - b) cornea
 - c) choroid layer
 - d) ciliary body
 - e) suspensory ligaments
 - f) iris
 - g) pupil
 - h) lens
 - i) cataracts
 - i) retina
 - j) rods
 - k) macula area
 - l) macula lutea
 - m) fovea
 - n) ganglion neurons
 - o) optic disc
- iv. cavities
- a) posterior cavity – vitreous humor
 - b) anterior cavity
 - i) aqueous humor--glaucoma
 - ii) canal of Schlemm
- v. physiology of vision
- a) refraction
 - i) nearsightedness – myopia
 - ii) farsightedness – hyperopia & presbyopia
 - iii) astigmatism
 - iv) strabismus
 - v) amblyopia
 - b) rods and rhodopsin
 - c) cones and color blindness
 - d) optic nerve
 - e) optic chiasma
 - f) occipital lobes of cerebral cortex
 - i) binocular vision
- j. Components and function of the ear
- i. outer ear
 - a) auricle – pinna
 - b) ear canal
 - ii. middle ear
 - a) eardrum – tympanic membrane
 - b) malleus
 - c) incus
 - d) stapes
 - e) oval window
 - f) eustachian tube

- iii. inner ear
 - a) bony labyrinth
 - b) membranous labyrinth
 - c) perilymph
 - d) endolymph
 - e) cochlea
 - i) medial canal
 - ii) organ of Corti
 - iii) round window
 - iv) utricle and saccule
 - (a) otoliths
 - v) Semicircular canals
 - f) process of hearing, vibration transmission and nerve impulse generation
 - i) deafness
 - (a) conduction deafness
 - (b) nerve deafness
 - (c) central deafness
 - g) physiology of equilibrium
- iv. proprioception
- v. arterial pressoreceptors and chemoreceptors

XIV. Integumentary System

- A. General Functions of the Integumentary System
- B. Layers and Functions of the Skin
 - 1. Epidermis
 - 2. Dermis
 - 3. Subcutaneous tissue
- C. Additional Skin Structures:
 - 1. Stratum corneum
 - 2. Stratum germinativum
 - 3. Melanocytes
 - 4. Melanin
- D. Cutaneous Senses
- E. Other Structures and Function
 - 1. Hair
 - 2. Nails
 - 3. Sebaceous glands
 - 4. Ceruminous glands
 - 5. Eccrine sweat glands
- F. Dermal Arterioles Response to Heat, Cold and Stress
- G. Structure and Function of Subcutaneous Tissue
- H. Skin Response to Injury and Repair Process
- I. Effects of the Aging Process on the Skin

XV. Digestive System

- A. General Function of the Digestive System and the Major Divisions
 - 1. Alimentary tube
 - 2. Accessory organs
- B. Accessory Organs of Digestion
- C. Mechanical and Chemical Digestion
- D. Structure and Function of the Teeth and Tongue
- E. Function of Saliva
- F. Location and Function of the Pharynx and Esophagus
- G. Mechanical and Chemical Breakdown of Food in the Mouth
- H. Mechanics of Swallowing
- I. Location, Structure, and Function of the Stomach, Small intestine, Liver, Gallbladder, and Pancreas
- J. Four Layers of the Alimentary Canal
 - 1. Mucosa
 - 2. Submucosa
 - 3. External muscle layer
 - 4. Serosa
- K. Absorption in the Large and Small Intestine
- L. Function of the Normal Flora in the Colon
- M. Peristalsis and Chime

XVI. Endocrine System

- A. Function of the Endocrine System
- B. Endocrine and Exocrine Glands
- C. Endocrine Glands and the Hormones Secreted
 - 1. Prostaglandin
 - 2. Target organs
 - 3. Target tissue
- D. Chemistry of Hormones
 - 1. Amines
 - 2. Proteins
 - 3. Steroids
- E. Regulation of Hormone Secretion
 - 1. Positive and negative feedback mechanisms
- F. Pituitary Gland
 - 1. Posterior pituitary gland
 - a. Antidiuretic hormone (ADH)
 - b. Osmoreceptors
 - c. Oxytocin
- G. Anterior Pituitary Gland
 - 1. Growth Hormone (GH)
 - 2. Thyroid-stimulating hormone (TSH)
 - 3. Adrenocorticotrophic Hormone (ACTH)
 - 4. Prolactin
 - 5. Follicle-stimulating hormone (FSH)
 - 6. Luteinizing hormone (LH)

- H. Thyroid Gland
 - 1. Thyroxine (T4)
 - a. goiter
 - b. cretinism
 - c. myxedema
 - d. Graves' disease
 - 2. Triiodothyronine (T3)
 - 3. Calcitonin
- I. Parathyroid hormone (PTH) and calcitonin
- J. Pancreas
 - 1. Islets of Langerhans
 - a. Alpha cells
 - b. Beta cells
 - c. Delta cells
 - 2. Insulin
 - a. Diabetes mellitus
 - b. Hyperglycemia
 - c. Hypoglycemia
 - 3. Glucagon
 - 4. Somatostatin
- K. Relationship Between Insulin and Glucagon
- L. Prostaglandins
- M. Adrenal Glands
 - 1. Adrenal medulla
 - a. epinephrine
 - b. norepinephrine
 - 2. Adrenal Cortex
 - a. Mineralocorticoids
 - i. aldosterone
 - ii. rennin-angiotensin mechanism
 - b. Glucocorticoids
 - i. cortisol
 - a) gluconeogenesis
 - b) anti-inflammatory effects -- histamine
 - c. Sex hormones
 - i. estrogen
 - ii. progesterone
 - iii. inhibin
 - iv. testosterone
 - d. Diseases of the adrenal cortex
 - i. Addison's disease
 - ii. Cushing's syndrome
- N. How Protein Hormones and Steroid Hormones Exert Their Effects
- O. Coordinated Physiological Responses Controlled by Hormones
- P. Hormones That Are Especially Important to Normal Growth and Development

XVII. Renal System

- A. Location and General Function of Each Organ in the Urinary System
- B. Components of a Nephron and the Associated Blood Vessels
- C. Process of Urine Formation
 - 1. Glomerular filtration,
 - 2. Tubular reabsorption
 - 3. Tubular secretion
 - 4. Kidney blood flow
- D. Kidneys Function in Maintaining Normal Blood Volume and Pressure
- E. Kidneys Maintenance of Normal Blood pH and Electrolyte Balance
- F. Hormones That Affect Kidney Function
 - 1. Aldosterone
 - 2. Atrial natriuretic peptide (ANP)
 - 3. Antidiuretic hormone(ADH)
 - 4. Parathyroid hormone (PTH)
- G. Urination Reflex and Voluntary Control
- H. Characteristics of Normal Urine
 - 1. Amount
 - 2. Color
 - 3. Specific gravity
 - 4. pH
 - 5. constituents
 - 6. nitrogenous wastes
- I. Water Compartments
- J. Water Movement Between the Compartments
- K. Water Entry and Exit in the Body
- L. Water and Electrolyte Distribution in the Body
- M. Basic Concepts Involved in the Control of Fluid and Electrolyte Regulation
- N. Buffering Systems That Balance the pH of the Intracellular and Extracellular Fluids

XVIII. Reproductive System

- A. Define the Following:
 - 1. Diploid
 - 2. Haploid
 - 3. Gametes
 - 4. Endometrium
 - 5. Genetic disease
 - 6. Homologous chromosomes
 - 7. Autosomes
 - 8. Sex chromosomes
 - 9. Genes
 - 10. Alleles
 - 11. Genotype
 - 12. Phenotype
 - 13. Homomzygous
 - 14. Heterozygous
- B. Spermatogenesis and Oogenesis

- C. Hormones Necessary for the Formation of Gametes
- D. Essential and Accessory Reproductive Organs of the Male and Female
- E. Structures That Constitute External Genitals in Both Sexes
- F. Parts of the Sperm Cell
- G. Life Cycle of an Oocyte
- H. Menstrual Cycle in Terms of Changes in Hormone Levels and the Condition of the Endometrium
- I. Major Developmental Changes During Gestation
- J. Function and Structure of the Placenta and Umbilical Cord
- K. Fetal Circulation/Respiration
- L. Average Gestation Period
- M. Stages of Labor
- N. Physiologic Changes in Infant After Birth

XIX. Lymphatic and Immune System

- A. Major Components and Functions of the Lymphatic System
- B. Formation of Lymph Fluid
- C. Lymph Vessels and Return to the Blood
- D. Location and Function of Lymph Nodes and the Spleen
- E. Lymphocytes
- F. Immunity
 - 1. Antigens
 - 2. antibodies
- G. Innate Immunity
 - 1. Defensive cells
 - a. Natural killer cells (NK cells)
 - b. Basophils
 - c. Mast cells
 - d. Phagocytes
 - e. Langerhans cells
 - 2. Chemical defenses
 - a. Interferons
 - b. Complement
 - c. Inflammation
 - d. Fever
- H. Adaptive Immunity
 - 1. Cell-mediated
 - 2. Antibody mediated
- I. Thymus
 - 1. Stem cells
 - 2. T lymphocytes – T cells
- J. Humoral immunity and Cell Mediated Immunity
- K. Development and Function of B Cells and T Cells
- L. Acquired Immunity and Genetic Immunity
- M. Vaccinations
- N. Classifications of Microorganisms
- O. Distribution of and Benefits of Normal Flora
- P. Infectious Disease

1. Methods by which infectious diseases are spread

XX. Nutrition, Metabolism and Body Temperature

- A. Normal Range of Body Temperature
- B. Homeostatic Mechanisms That Maintain a Constant Body Temperature
- C. Metabolism, Catabolism, Anabolism, Basal Metabolic Rate, Kilo-Calories
- D. Methods Heat is Generated and Lost in the Body
 1. Thyroxine
 2. Sympathetic stimulation
 3. Respiration
 4. Skeletal muscles
 5. Liver
 6. Food
- E. Fever
 1. Cause
 2. Advantages
 3. Disadvantages
- F. Hypothalamus Function as the Thermostat in the Body
- G. Cell Respiration
 1. Byproducts
 2. Disposal of byproducts
- H. Cellular Metabolism
 1. Metabolic roles of fats, glucose, and proteins
 2. Synthesis uses for glucose, amino acids and fats
 3. Metabolic rate and kilocalories
 4. Factors that affect metabolic rate
- I. Functions of Vitamins, Minerals, and Other Important Nutrients
 1. Basic food groups
 2. Minerals, vitamins and water
 3. Significance of caloric value of foods