SALEM COMMUNITY COLLEGE COURSE SYLLABUS

Section I

Course Title: Anatomy And Physiology I

Course Code: BIO 220

Lecture Hours: 2
Lab Hours: 4
Credits: 4

Course Description:

Human Anatomy and Physiology I is the first course of the Anatomy and Physiology sequence. It focuses on the comprehensive study of the structure and function of the gross and microscopic organization of the human body. Emphasis is placed on the language of anatomy, the integumentary, skeletal, muscular, and nervous systems, along with a review of chemistry and cell biology. Laboratories are designed to supplement the lecture material and include the dissection of a sheep brain and use of histology slides, models, charts, computer programs, collection of laboratory data, and clinical data case studies pertinent to the systems covered. This is a state approved General Education Science course.

Prerequisites:

1. Successful completion of **ALL DEVELOPMENTAL COURSES**

2. BIO 150 or BIO 101 with a "C" or better within the last five years

Co-requisite:
None

Place in College Curriculum:

Requirement in the Associate Degree programs in Health Science (including all options), Occupational Therapy Assistant, Respiratory Therapy, Health Information Technology, and Nursing, and the Certificate program in Practical Nursing. Course also serves as a 4 credit General Education Science elective for any student.

Date of Last Revisions:
March 2015

Section II

Course Content Outline:

A. Body Plan & Organization

1. Anatomical position
2. Body planes & sections
3. Body cavities & regions
4. Directional terms
5. Basic terminology
6. Levels of organization
7. Survey of body systems

B. Homeostasis

1. General types of homeostatic mechanisms
2. Examples of homeostatic mechanisms
3. Application of homeostatic mechanisms
4. Predictions related to homeostatic imbalance, including disease states & disorders

C. Chemistry and Cell Biology Review

1. Atoms & molecules
2. Chemical bonding
3. Inorganic compounds & solutions
4. Organic compounds
5. Energy transfer using ATP
6. Intracellular organization of nucleus & cytoplasm
7. Membrane structure & function
8. Mechanisms for movement of materials across cell membranes
9. Organelles
10. Protein synthesis
11. Cellular respiration (introduction)
12. Somatic cell division
13. Reproductive cell division
14. Application of homeostatic mechanisms
15. Predictions related to homeostatic imbalance, including disease states & disorders

E. Histology

1. Overview of histology & tissue types
2. Microscopic anatomy, location, & functional roles of epithelial, connective, muscular and nervous tissues
3. Membranes (mucous, serous, cutaneous & synovial)
4. Glands (exocrine & endocrine)
5. Tissue repair

F. Integumentary System

1. General functions of the skin & the subcutaneous layer
2. Gross & microscopic anatomy of the skin
3. Roles of specific tissue layers of skin & the subcutaneous layer
4. Anatomy & functional roles of accessory structures
5. Application of homeostatic mechanisms
6. Predictions related to homeostatic imbalance, including disease states & disorders

G. Skeletal System & Articulations

1. General functions of bone & the skeletal system
2. Structural components – microscopic anatomy
3. Structural components – gross anatomy
4. Physiology of embryonic bone formation (ossification, osteogenesis)
5. Physiology of bone growth, repair & remodeling
6. Organization of the skeletal system
7. Gross anatomy of bones
8. Classification, structure & function of joints (articulations)
9. Application of homeostatic mechanisms
10. Predictions related to homeostatic imbalance, including disease states & disorders

H. Muscular System

1. General functions of muscle tissue
2. Identification, general location, & comparative characteristics of skeletal, smooth, & cardiac muscle tissue
3. Detailed gross & microscopic anatomy of skeletal muscle
4. Physiology of skeletal muscle contraction
5. Skeletal muscle metabolism
6. Principles & types of whole muscle contraction
7. Nomenclature of skeletal muscles
8. Location & function of skeletal muscles
9. Group actions of skeletal muscles
10. Lever systems
11. Application of homeostatic mechanisms
12. Predictions related to homeostatic imbalance, including disease states & disorders

I. Nervous System

1. General functions of the nervous system
2. Organization of the nervous system from both anatomical & functional perspectives
3. Gross & microscopic anatomy of nervous tissue
4. Neurophysiology, including mechanism of resting membrane potential, production of action potentials, & impulse transmission
5. Neurotransmitters & their roles in synaptic transmission
6. Sensory receptors & their roles
7. Division, origin, & function of component parts of the brain
8. Protective roles of the cranial bones, meninges, & cerebrospinal fluid
9. Structure & function of cranial nerves
10. Anatomy of the spinal cord & spinal nerves
11. Reflexes & their roles in nervous system function
12. Physiology of sensory & motor pathways in the brain & spinal cord
13. Functions of the autonomic nervous system
14. Comparisons of somatic & autonomic nervous systems
15. Application of homeostatic mechanisms
16. Predictions related to homeostatic imbalance, including disease states & disorders

Section III

Course Performance Objective #1: Body Plan & Organization

Students who have completed this section of the course should be able to understand the scope of studies in anatomy and physiology and be able to use and understand descriptive anatomical and directional terminology.

Learning Outcomes:

1. Describe a person in anatomical position.
2. Describe how to use the terms right and left in anatomical reference.
3. Identify the various planes in which a body might be dissected.
4. Describe the appearance of a body presented along various planes.
5. Describe the location of the body cavities and identify the major organs found in each cavity.
6. List and describe the location of the major anatomical regions of the body.
7. Describe the location of the four abdominopelvic quadrants and the nine abdominopelvic regions and list the major organs located in each.
8. List and define the major directional terms used in anatomy.
9. Use appropriate directional terminology to describe the location of body structures.
10. Define the terms anatomy and physiology.
11. Give specific examples to show the interrelationship between anatomy and physiology.
12. Use basic regional and systemic terminology to locate and identify structures of the body.
13. Describe, in order from simplest to most complex, the major levels of organization in the human organism.
14. Give an example of each level of organization.
15. Identify the organ systems of the human body and their major components.
16. Describe the major functions of each organ system.

Course Performance Objective #2: Homeostasis

Students who have completed this section of the course should be able to explain the basic concept of homeostasis and how homeostatic mechanisms apply to body systems.

Learning Outcomes:

1. Define homeostasis.
2. List the components of a feedback loop and explain the function of each.
3. Compare and contrast positive and negative feedback in terms of the relationship between stimulus and response.
4. Explain why negative feedback is the most commonly used mechanism to maintain homeostasis in the body.
5. Provide an example of a negative feedback loop that utilizes the nervous system to relay information. Describe the specific organs, structures, cells or molecules (receptors, neurons, CNS structures, effectors, neurotransmitters) included in the feedback loop.
6. Provide an example of a negative feedback loop that utilizes the endocrine system to relay information. Describe the specific cells or molecules (production cells, hormones, target cells) included in the feedback loop.
7. Provide an example of a positive feedback loop in the body. Describe the specific structures (organs, cells or molecules) included in the feedback loop.
8. Provide specific examples to demonstrate how organ systems respond to maintain homeostasis.
9. Explain how different organ systems relate to one another to maintain homeostasis.
10. Predict factors or situations affecting various organ systems that could disrupt homeostasis.

11. Predict the types of problems that would occur in the body if various organ systems could not maintain homeostasis and allowed regulated variables (body conditions) to move away from normal.
12. Utilize concepts of the scientific method to investigate laboratory/clinical data related to homeostasis.

Course Performance Objective #3: Chemistry and Cell Biology Review

This portion of the class will serve to review prior knowledge of Chemistry and Cell Biology. Students who have completed this section of the course should be able to understand the chemical principles related to anatomy and physiology and should be able to identify cellular structures and explain their respective functions.

Learning Outcomes:

1. With respect to the structure of an atom:
    a. Describe the charge, mass, and relative location of electrons, protons and neutrons.
    b. Relate the number of electrons in an electron shell to an atom's chemical stability and its ability to form chemical bonds.
    c. Explain how ions and isotopes are produced by changing the relative number of specific subatomic particles.
    d. Distinguish among the terms atomic number, mass number and atomic weight.
2. Compare and contrast the terms ions, electrolytes, free radicals, isotopes and radioisotopes.
3. Compare and contrast the terms atoms, molecules, elements, and compounds.
4. With respect to non-polar covalent, polar covalent, ionic, and hydrogen bonds:
    a. List each type of bond in order by relative strength.
    b. Explain the mechanism of each type of bond.
    c. Provide biologically significant examples of each.
5. Discuss the physiologically important properties of water.
6. Distinguish among the terms solution, solute, solvent, colloid suspension, and emulsion.
7. Define the term salt and give examples of physiological significance.
8. Define the terms pH, acid, base, and buffer and give examples of physiological significance.
9. State acidic, neutral, and alkaline pH values.
10. Define the term organic molecule.
11. Explain the relationship between monomers and polymers.
12. Define and give examples of dehydration synthesis and hydrolysis reactions.
13. With respect to carbohydrates, proteins, lipids and nucleic acids:
    a. Identify the monomers and polymers.
    b. Compare and contrast general molecular structure.
    c. Provide specific examples.
    d. Identify dietary sources.
    e. Discuss physiological and structural roles in the human body.
14. Describe the four levels of protein structure and discuss the importance of protein shape for protein function.
15. Demonstrate factors that affect enzyme activity, including denaturation, and interpret graphs showing the effects of various factors on the rate of enzyme-catalyzed reactions.
16. Describe the generalized reversible reaction for release of energy from ATP and explain the role of ATP in the cell.
17. Identify the three main parts of a cell, and list the general functions of each.
18. Explain how cytoplasm and cytosol are different.
19. Describe how lipids are distributed in a cell membrane, and explain their functions.
20. Describe how carbohydrates are distributed in a cell membrane, and explain their functions.
21. Describe how proteins are distributed in a cell membrane, and explain their functions.
22. With respect to the following membrane transport processes – simple diffusion, facilitated diffusion, osmosis, active transport, exocytosis, endocytosis, phagocytosis, pinocytosis, & filtration:

    a. State the type of material moving in each process.
    b. Describe the mechanism by which movement of material occurs in each process.
    c. Discuss the energy requirements and, if applicable, the sources of energy for each process.
    d. Give examples of each process in the human body.
23. Describe the effects of hypertonic, isotonic, and hypotonic conditions on cells.
24. Demonstrate various cell transport processes and, given appropriate information, predict the outcomes of these demonstrations.
25. Define the term organelle.
26. For each different type of organelle associated with human cells:
    a. Identify the organelle.
    b. Describe the structure of the organelle.
    c. Describe the function of the organelle
27. Define the terms genetic code, transcription and translation.
28. Explain how and why RNA is synthesized.
29. Explain the roles of tRNA, mRNA, and rRNA in protein synthesis.
30. Define the term cellular respiration.
31. With respect to glycolysis, the Krebs (citric acid or TCA) cycle, and the electron transport chain: Compare and contrast energy input, efficiency of energy production, oxygen use, by-products and cellular location.
32. Referring to a generalized cell cycle, including interphase and the stages of mitosis:
    a. Describe the events that take place in each stage.
    b. Identify cells that are in each stage.
    c. Analyze the functional significance of each stage.
33. Distinguish between mitosis and cytokinesis.
34. Describe DNA replication.
35. Analyze the interrelationships among chromatin, chromosomes and chromatids.
36. Give examples of cell types in the body that divide by mitosis and examples of circumstances in the body that require mitotic cell division.
37. Describe the events that take place in each stage of meiosis I and meiosis II.
38. Identify cells that are in each stage of meiosis I and meiosis II.
39. Compare and contrast the general features of meiosis I and meiosis II.
40. Compare and contrast the processes of mitosis and meiosis.
41. Give examples of cell types in the body that divide by meiosis and examples of circumstances in the body that require meiotic cell division. Provide specific examples to demonstrate how individual cells respond to their environment (e.g., in terms of organelle function, transport processes, protein synthesis, or regulation of cell cycle) in order to maintain homeostasis in the body.
42. Predict factors or situations that could disrupt organelle function, transport processes, protein synthesis, or the cell cycle.
43. Predict the types of problems that would occur if the cells could not maintain homeostasis due to abnormalities in organelle function, transport processes, protein synthesis, or the cell cycle.

Course Performance Objective #4: Histology

Students who have completed this section of the course should be able to describe the basic tissues of the body and their location and explain their functions.

Learning Outcomes:

1. Define the term histology.
2. List the four major tissue types.
3. Contrast the general features of the four major tissue types.
4. Classify the different types of epithelial tissues based on distinguishing structural characteristics.

5. Identify locations in the body where each type of epithelial tissue can be found.
6. Describe the functions of each type of epithelial tissue in the human body and correlate function with structure for each tissue type.
7. Identify the different types of epithelial tissue using proper microscope technique.
8. Describe how injuries and aging affect epithelial tissue.
9. Classify the different types of connective tissues based on distinguishing structural characteristics.
10. Identify locations in the body where each type of connective tissue can be found.
11. Describe functions of each type of connective tissue in the human body and correlate function with structure for each tissue type.
12. Compare and contrast the roles of individual cell types and fiber types within connective tissue.
13. Identify the different types of connective tissue using proper microscope technique.
14. Describe how injuries and aging affect connective tissue.
15. Classify the different types of muscle tissues based on distinguishing structural characteristics and location in the body.
16. Describe functions of each type of muscle tissue in the human body and correlate function with structure for each tissue type.
17. Identify the different types of muscle tissue using proper microscope technique.
18. Describe how injuries and aging affect muscular tissue.
19. Identify locations in the body where nervous tissue can be found.
20. Describe the structure and function of neurons and neuroglial cells in nervous tissue and correlate function with structure for the different types of neuroglial cells.
21. Identify neurons and neuroglial cells using proper microscope technique.
22. Describe how injuries and aging affect nervous tissue.
23. Describe the structure and function of mucous, serous, cutaneous & synovial membranes.
24. Identify locations in the body where each type of membrane can be found.
25. Distinguish between exocrine and endocrine glands, structurally and functionally.
26. Identify example locations in the body of exocrine and endocrine glands.
27. Classify the different kinds of exocrine glands based on structure and function.
28. Describe the stages in tissue repair following an injury.

Course Performance Objective #5: Integumentary System

Students who have completed this section of the course should be able to identify and describe the major gross and microscopic anatomical components of the integumentary system and describe the functions of the system.

Learning Outcomes:

1. Describe the general functions of the skin.
2. Describe the general functions of the subcutaneous layer (also known as the hypodermis or superficial fascia).
3. With respect to the epidermis:
    a. Identify and describe the tissue type making up the epidermis.
    b. Identify and describe the layers of the epidermis, indicating which are found in thin skin and which are found in thick skin.
    c. Correlate the structure of thick and thin skin with the locations in the body where each are found.
4. Describe the processes of growth and keratinization of the epidermis.
5. Identify and describe the dermis and its layers, including the tissue types making up each dermal layer.
6. Identify and describe the subcutaneous tissue, including the tissue type***s*** making up subcutaneous tissue.
7. With respect to skin color:
    a. Identify and describe the three pigments most responsible for producing the various skin colors.
    b. Identify which layers of the skin contain each of these pigments.
8. With respect to the epidermis:

a. Describe the functions of the epidermis.
b. Explain how each of the five layers, as well as each of the following cell types and substances, contributes to the functions of the epidermis: stem cells of stratum basale, keratinocytes, melanocytes, Langerhans cells, Merkel cells and discs, keratin, and extracellular lipids.
c. Explain why the histology of the epidermis is well suited for its functions.

9. With respect to the dermis:
    a. Describe the overall functions of the dermis.
    b. Describe the specific function of each dermal layer and relate that function to the skin's overall functions.
    c. Evaluate the advantages and disadvantages of the structure of the papillary and the reticular layers/regions.
10. With respect to the subcutaneous layer:
    a. Describe the functions of the subcutaneous layer.
    b. Evaluate the advantages and disadvantages of having areolar connective tissue in this layer.
11. Analyze the benefits of skin being a multilayered organ.
12. Describe the process of tissue or wound repair.
13. Describe the thermoregulatory role played by adipose tissue in the subcutaneous layer.
14. Analyze the changes in skin structure and function that occur with aging.
15. With respect to the following - sweat glands (eccrine and apocrine), sebaceous glands, nails, hair (follicle and arrector pili muscle), and sensory receptors (Merkel cell, Meissner's & Pacinian corpuscles, hair follicle receptor, and temperature receptors):
    a. Identify each structure.
    b. Give the location of each structure in the body.
    c. Describe the anatomy of each structure.
    d. Describe the function of each structure.
16. Describe the growth cycles of hair follicles and the growth of hairs.
17. Explain the physiological importance of the presence or absence of sebaceous glands, sweat glands, and hair in the skin of the palms and fingers.
18. Provide specific examples to demonstrate how the integumentary system responds to maintain homeostasis in the body.
19. Explain how the integumentary system relates to other body systems to maintain homeostasis.
20. Predict factors or situations affecting the integumentary system that could disrupt homeostasis.
21. Predict the types of problems that would occur in the body if the integumentary system could not maintain homeostasis.
22. Utilize concepts of the scientific method to investigate laboratory/clinical data related to the integumentary system.

Course Performance Objective #6: Skeletal System & Articulations

Students who have completed this section of the course should be able to identify and describe the major gross and microscopic anatomical components of the skeletal system and explain their functional roles in osteogenesis, repair, and body movement.

Learning Outcomes:

1. Describe the general functions of the skeletal system.
2. List and describe the cellular and extracellular components of bone tissue.
3. Identify the internal structural components of compact bone and spongy bone.
4. Identify the types of cartilage tissues that are found in the skeletal system and explain the functions of each.
5. Explain the roles of dense regular and dense irregular connective tissue in the skeletal system.
6. Identify the structural components of a long bone, with emphasis on region of longitudinal growth.

7. Explain the functions of those structural components in the context of a whole bone.
8. Explain the roles osteogenic cells play in the formation of bone tissue.
9. Compare and contrast intramembranous and endochondral (intracartilagenous) bone formation
10. Compare and contrast the function of osteoblasts and osteoclasts during bone growth, repair, and remodeling.
11. Explain the hormonal regulation of skeleton growth.
12. Explain the roles of calcitonin, parathyroid hormone and calcitriol in bone remodeling and blood calcium regulation.
13. Contrast the remodeling processes of a child (birth to adolescence) and an adult (middle to old age).
14. Define the two major divisions of the skeletal system (axial and appendicular) and list the general bone structures contained within each.
15. Identify the types of bones based on shape and composition (compact vs. spongy), and relate the shapes of bones to their functions.
16. Identify the individual bones and their location within the body.
17. Identify bone markings (spines, processes, foramina, etc.) and describe their function (e.g., point of articulation, muscle tendon attachment, ligament attachment, passageway for nerves and vessels).
18. Compare and contrast the skull of a fetus/infant with the skull of an adult.
19. Compare and contrast the adult male and female skeletons.
20. With respect to classification of joints:
    a. Describe the functional classification, based on degree of movement allowed - synarthrotic, amphiarthrotic, and diarthrotic – and provide examples of each type.
    b. Describe the anatomical classification, based on structure - fibrous, cartilaginous, and synovial – and provide examples of each type.
    c. Explain how the functional and anatomical classifications are related.
21. Identify the structural components of the synovial joint, including accessory structures like bursae, tendon sheaths, and ligaments.
22. Describe and demonstrate the generalized movements of synovial joints.
23. For each of the six structural types of synovial joints:
    a. Describe the anatomical features of that structural type.
    b. Identify locations in the body where each structural type can be found.
    c. Predict the kinds of movements that each structural type will allow.
24. Describe how the aging process affects joints and the joint components and how it affects movement ability.
25. Provide specific examples to demonstrate how the skeletal system and articulations respond to maintain homeostasis in the body.
26. Explain how the skeletal system and articulations relate to other body systems to maintain homeostasis.
27. Predict factors or situations affecting the skeletal system and articulations that could disrupt homeostasis.
28. Predict the types of problems that would occur in the body if the skeletal system and articulations could not maintain homeostasis.
29. Utilize concepts of the scientific method to investigate laboratory/clinical data related to the skeletal system.

Course Performance Objective #7: Muscular System

Students who have completed this section of the course should be able to identify and describe the major gross and microscopic anatomical components of the muscular system and explain their functional roles in body movement, maintenance of posture, and heat production.

Learning Outcomes:

1. List and explain the functions of muscle tissue.

2. Identify skeletal, cardiac and smooth muscle.
3. Describe the structure, location in the body and function of skeletal, cardiac and smooth muscle.
4. Compare and contrast the characteristics of skeletal, cardiac and smooth muscle.
5. Describe the organization of muscle tissue from cell to whole muscle to groups of muscles.
6. Name the connective tissue layers that surround each cell, fascicle, muscle, and group of muscles and indicate the specific type of connective tissue that composes all of these layers.
7. Describe a skeletal muscle fiber including the transverse (T) tubules, sarcoplasmic reticulum and myofibrils.
8. Explain the organization of a myofibril.
9. Name, and describe the function of, each of the contractile, regulatory, and structural protein components of a sarcomere.
10. Describe the anatomy of the neuromuscular junction.
11. List the anatomical and metabolic characteristics of fast, slow, and intermediate muscle fibers.
12. Explain the sliding filament theory of muscle contraction.
13. Describe the sequence of events involved in the contraction cycle of skeletal muscle.
14. Explain how an electrical signal from the nervous system arrives at the neuromuscular junction.
15. Describe, in order, the events that occur at the neuromuscular junction that elicit an action potential in the muscle fiber.
16. Explain what is meant by the expression "excitation- contraction coupling".
17. List the sources of energy stored in a typical muscle fiber.
18. Describe the mechanisms that muscle fibers use to obtain ATP for muscle contraction.
19. Explain the factors that contribute to muscle fatigue.
20. Summarize the events that occur during the recovery period of muscle contraction.
21. Compare and contrast the metabolism of skeletal, cardiac and smooth muscle.
22. Interpret a myogram of a twitch contraction with respect to the duration of the latent, contraction and relaxation periods and describe the events that occur in each period.
23. Define the terms tension and contraction, with respect to muscles.
24. Define the term motor unit.
25. With respect to the mechanisms by which muscles generate variable amounts of tension:
    a. Interpret a myogram or graph of tension vs. stimulus frequency and explain the physiological basis for the phenomena of treppe, summation and tetanus.
    b. Interpret a myogram or graph of tension vs. stimulus intensity and explain the physiological basis for the phenomenon of recruitment.
    c. Interpret a graph of the length-tension relationship and discuss the anatomical basis for that relationship.
26. Demonstrate isotonic and isometric contraction and interpret graphs of tension vs. time and muscle length vs. time for each type of contraction.
27. Demonstrate concentric and eccentric contraction and contrast the relative tension and resistance that exists, as well as the change in muscle length that occurs, in each type of contraction.
28. Explain how the name of a muscle can help identify its action, appearance, or location.
29. Identify the origin, insertion and action of the major skeletal muscles and demonstrate these muscle actions.
30. Define the terms prime mover (or agonist), antagonist, synergist and fixator.
31. For a given movement, differentiate specific muscles that function as prime mover, antagonist, synergist or fixator.
32. Differentiate among the three classes of levers in terms of the relative position of fulcrum, effort and load, as well as in terms of the relative power and range of motion.
33. Give examples in the human body of muscles and their associated joints to illustrate each type of lever system.
34. Provide specific examples to demonstrate how the muscular system responds to maintain homeostasis in the body
35. Explain how the muscular system relates to other body systems to maintain homeostasis.

36. Predict factors or situations affecting the muscular system that could disrupt homeostasis.
37. Predict the types of problems that would occur in the body if the muscular system could not maintain homeostasis.
38. Utilize concepts of the scientific method to investigate laboratory/clinical data related to the muscular system.

Course Performance Objective #8: Nervous System

Students who have completed this section of the course should be able to identify and describe the major gross and microscopic anatomical components of the nervous system and explain their functional roles in communication, control, and integration.

Learning Outcomes:

1. Describe the overall functions of the nervous system.
2. Describe the nervous system as a control system identifying nervous system elements that are sensory receptors, the afferent pathway, control centers, the efferent pathway, and effector organs.
3. Indicate which parts of the nervous system are sensory, and which are motor.
4. Differentiate between the somatic and autonomic divisions of the nervous system.
5. List the parts of the nervous system that constitute the central nervous system (CNS) and those that constitute the peripheral nervous system (PNS).
6. With respect to the three structural types of neurons (unipolar, bipolar & multipolar):
    a. Identify each type of neuron.
    b. Identify soma (cell body), axon, and dendrites.
    c. Indicate which parts of each type of neuron receive information, which parts integrate information, and which parts conduct the output signal of the neuron.
    d. Describe the location of the cell bodies of each type of neuron within the nervous system.
    e. Give a function of each type of neuron.
    f. Describe how the anatomy of each type of neuron supports its function.
7. With respect to glial cells found in the CNS:
    a. List four types of CNS glial cells.
    b. Give functions for each of those cells.
    c. Describe how the anatomy of each CNS glial cell supports its function.
8. With respect to glial cells found in the PNS:
    a. List two types of PNS glial cells.
    b. Give functions for each of those cells.
    c. Describe how the anatomy of each PNS glial cell supports its function.
9. Define the term nerve.
10. Differentiate between a nerve and a CNS tract.
11. Define permeability.
12. Explain how ion channels affect neuron selective permeability.
13. Contrast the relative concentrations of sodium, potassium and chloride ions inside and outside of a cell.
14. Differentiate between a concentration gradient and an electrical potential.
15. Define electrochemical gradient.
16. With respect to ion channels:
    a. Differentiate between passive and active ion channels.
    b. Explain how passive ion channels cause development of the resting membrane potential in neurons.
    c. Differentiate between voltage-gated and chemically-gated ion channels.
    d. Identify the voltage-gated ion channels that are essential for development of the action potential.
17. Discuss the sequence of events that must occur for an action potential to be generated.

18. Describe the role of the sodium-potassium exchange pump in maintaining the resting membrane potential and making continued action potentials possible.
19. Define threshold.
20. Discuss the role of positive feedback in generation of the action potential.
21. Interpret a graph showing the voltage vs. time relationship of an action potential, and relate the terms depolarize, repolarize, and hyperpolarize to the events of an action potential.
22. With respect to the refractory periods:
    a. Define absolute and relative refractory periods.
    b. Explain the physiological basis of the absolute and relative refractory periods.
    c. Discuss the consequence of a neuron having an absolute refractory period.
23. With respect to impulse conduction:
    a. Describe how local circuit currents cause impulse conduction in an unmyelinated axon.
    b. Explain how axon diameter and myelination affect conduction velocity.
24. Describe saltatory conduction.
25. Identify the presynaptic and postsynaptic cells at a synapse.
26. List the structures that comprise a chemical synapse.
27. Describe the synaptic (axon) terminal.
28. Restate the steps that lead from the action potential arriving in the synaptic terminal to the release of neurotransmitter from synaptic vesicles.
29. Discuss the relationship between a neurotransmitter and its receptor.
30. Explain how the receptors for neurotransmitters are related to chemically-gated ion channels.
31. Describe the events of synaptic transmission in proper chronological order.
32. Define excitatory postsynaptic potential (EPSP) and inhibitory postsynaptic potential (IPSP) and interpret graphs showing the voltage vs. time relationship of an EPSP and an IPSP.
33. Explain temporal and spatial summation of synaptic potentials.
34. Explain how movement of sodium ions alone, or movement of both sodium and potassium ions, across the postsynaptic cell membrane can excite a neuron.
35. Explain how movement of potassium or chloride ions across the postsynaptic cell membrane can inhibit a neuron.
36. Compare and contrast synaptic potentials with action potentials.
37. Explain how a single neurotransmitter may be excitatory at one synapse and inhibitory at another.
38. Describe the mechanism by which neurotransmitters may have indirect (metabotropic) effects on postsynaptic cells.
39. List the most common excitatory neurotransmitter(s) in the CNS and the most common inhibitory neurotransmitter(s) in the CNS.
40. Propose a possible CNS function for each biogenic amine neurotransmitter
41. Compare and contrast chemical and electrical synapses.
42. List the five developmental regions of the brain and identify the major areas of the adult brain that arise from each region.
43. Correlate functions with each major area of the adult brain.
44. Describe the orientation of the brain relative to bones of the skull.
45. Identify the five lobes of the cerebral cortex and describe how the motor and sensory functions of the cerebrum are distributed among the lobes.
46. Explain why the sensory and motor homunculi are relevant clinically.
47. Discuss the concept of cerebral hemispheric specialization and the role of the corpus callosum in connecting the two halves of the cerebrum.
48. Describe the location and functions of the limbic system.
49. Describe the parts of the brain involved in storage of long term memory and discuss possible mechanisms of memory consolidation.
50. Describe the location and functions of the reticular activating system.
51. Describe how the bones of the skull protect the brain.
52. Identify the meninges and describe their functional relationship to the brain and cranial bones.

53. Describe the functions of cerebrospinal fluid, as well as the details of its production, its circulation within the central nervous system, and its ultimate reabsorption into the bloodstream.
54. Describe the structural basis for, and the importance of the blood brain barrier.
55. List the cranial nerves by name and number.
56. Describe the specific functions of each of the cranial nerves and also indicate if each is sensory, motor or mixed
57. Identify the ganglia associated with the cranial nerves.
58. Discuss the location of the cranial nerve nuclei.
59. Propose how knowledge of the anatomy of cranial nerve nuclei can be used to help pinpoint damage to particular regions of the brain stem.
60. Describe the gross anatomy of the spinal cord and spinal nerves and specify their location relative to the anatomy of the skeletal system.
61. Identify the anatomical features seen in a cross sectional view of the spinal cord.
62. Contrast the relative position of gray matter and white matter in the spinal cord with the corresponding arrangement of gray and white matter in the brain.
63. Identify the dorsal root ganglia, dorsal and ventral roots, and spinal nerves.
64. Discuss how the structures root, nerve, ramus, plexus, tract and ganglion relate to one another.
65. List the four spinal nerve plexuses and give examples of nerves that emerge from each.
66. Distinguish between ascending and descending tracts in the spinal cord.
67. Describe the concept of dermatomes and explain why they are clinically significant.
68. Define the term reflex.
69. Describe reflex responses in terms of the major structural and functional components of a reflex arc.
70. Distinguish between the following types of reflexes:
    a. intrinsic (inborn) reflexes vs. learned reflexes.
    b. somatic vs. visceral reflexes.
    c. monosynaptic vs. polysynaptic reflexes.
    d. ipsilateral vs. contralateral reflexes.
71. Explain the terms spinal reflex and intersegmental spinal reflex.
72. Describe each of the reflexes itemized below, identifying all components of the reflex arc:
    a. stretch reflex
    b. flexor (withdrawal) reflex
    c. crossed-extensor reflex
73. Demonstrate a stretch reflex (e.g., patellar or plantar).
74. Propose how specific reflexes would be used in clinical assessment of nervous system function.
75. Describe the locations and functions of the first-, second- and third-order neurons in a sensory pathway.
76. Describe the locations and functions of the upper and lower motor neurons in a motor pathway.
77. Explain how decussation occurs in sensory and motor pathways & predict how decussation impacts the correlation of brain damage and symptoms in stroke patients.
78. Discuss the two divisions of the autonomic nervous system and the general physiological roles of each.
79. Contrast the anatomy of the parasympathetic and sympathetic systems, including central nervous system outflow locations, ganglia locations, pre- and post-ganglionic neuron relative lengths, and ganglionic and effector neurotransmitters.
80. Describe examples of specific effectors dually innervated by the two branches of the autonomic nervous system and explain how each branch influences function in a given effector.
81. Describe examples of effectors innervated by only the sympathetic branch or the parasympathetic branch of the nervous system and explain how that branch by itself influences function in a given effector.
82. Contrast sympathetic innervation of the adrenal gland with sympathetic innervation of other effectors.
83. Describe visceral reflex arcs, including structural and functional details of sensory and motor (autonomic) components.
84. Differentiate between cholinergic and adrenergic nerve fibers and discuss the physiological interactions of transmitters released by these neurons with specific cholinergic and adrenergic receptor subtypes.

85. Propose clinical uses of specific drugs that act at cholinergic and adrenergic receptor subtypes.
86. Describe major parasympathetic and/or sympathetic physiological effects on target organs.
87. Distinguish between the effectors of the somatic and autonomic nervous systems.
88. Contrast the cellular anatomy of the somatic and autonomic motor pathways.
89. Identify the terminal neurotransmitters *(*at the effector) in the somatic versus autonomic motor pathways and indicate whether the effector responses are excitatory or inhibitory.
90. Provide specific examples to demonstrate how the nervous system responds to maintain homeostasis in the body.
91. Explain how the nervous system relates to other body systems to maintain homeostasis.
92. Predict factors or situations affecting the nervous system that could disrupt homeostasis.
93. Predict the types of problems that would occur in the body if the nervous system could not maintain homeostasis.
94. Utilize concepts of the scientific method to investigate laboratory/clinical data related to the nervous system.

Section IV

General Education Requirements:

The general education goals covered in BIO220 are critical thinking & problem solving, quantitative skills, and science & technology.

Section V

Outcomes Assessment:

A college-wide outcomes assessment program has been put into place to enhance the quality and effectiveness of the curriculum and programs at Salem Community College. As part of this assessment program, the learning outcomes for this course will be assessed. Assessment methods may include tests, quizzes, papers, reports, projects and other instruments. Copies of all outcomes assessments are available in an electronic assessment bank maintained by the Institutional Research and Planning Office.

Section VI

Course Activities:

Lecture and class participation are the major means of instruction. Powerpoint lectures, videos, charts, models and microscopic views are incorporated into the lecture and laboratory portion of the course. The Laboratory portion includes the dissection of a sheep brain, microscope work and drawings, various exercises involving anatomic models, charts, and reference materials that correspond to the systems under study, along with the collection with laboratory data and clinical case studies related to system being covered..

Course Requirements and Means of Evaluation:

Please refer to the instructor's syllabus addendum (to be distributed in class) for specific information regarding the course requirements and means of evaluation.

Attendance Policy:

Regular and prompt attendance in all classes is expected of students. Students absent from class for any reason are responsible for making up any missed work. Faculty members establish an attendance policy for each course and it is the student's responsibility to honor and comply with that policy.

Academic Honesty Policy:

Students found to have committed an act of academic dishonesty may be subject to failure of this course, academic probation, and / or suspension from the college. See the Student Handbook for additional details.

ADA Statement:
If you have a 504 Accommodation Plan, please discuss it with your instructor. If you have any disability but have not documented it with the Disability Support coordinator at Salem Community college, you must do so to be eligible for accommodations. To contact the Disability Support Coordinator, call 856-351-2773, or email disabilitysupport@salemcc.edu to set up an appointment. To find out more information about disability support services at Salem Community College, visit www.salemcc.edu/students/student-success-programs/disability-support.

Section VII

Required Text(s): For textbook information, please see the Salem Community College Bookstore website.

Section VIII

Additional Costs:
None

References:
None