

Date Adopted:
Date Reviewed: 2001
Date Revised: 1990, 1998, 2001

<u>BIO</u>	<u>103</u>	<u>PRINCIPLES OF BIOLOGY I</u>	<u>REGULAR ADMISSION STATUS</u>
Prefix	No.	Course Title	Prerequisite

Credit Hours: 4 **Contact Hours: Lecture** 3 **Laboratory** 2

I. COURSE DESCRIPTION

This is an introductory course for science majors. It covers physical, chemical, and biological principles common to all organisms. These principles are taught through the study of cell structure and function, cellular reproduction, basic biochemistry, cell energetics, the process of photosynthesis, and Mendelian and molecular genetics. Also included are the scientific method, basic principles of evolution, and an overview of the diversity of life with emphasis on viruses, prokaryotes and protists.

II. GENERAL COURSE COMPETENCIES

After having completed this course, the student will have learned the following basic concepts. He/she will:

- A. Understand the application of the scientific method in biology.
- B. Understand the principle differences that separate the biota and the abiota.
- C. Understand the theories of origin of life on earth.
- D. Know that all matter, including that making up living organisms, is composed of chemical units with characteristic structures and properties at each level of organization.
- E. Know the general structures of the four groups of macromolecules and the major functions of each group in organisms and be able to give examples of each.
- F. Recognize the role of cells in organisms and understand why and how a cell interacts with its environment, including other cells.
- G. Differentiate between prokaryotic and eukaryotic cells.
- H. Describe the intercellular structure of a eukaryotic cell.
- I. Understand the diversity of life at the various levels of organization.
- J. Understand how the energy required to drive various chemical reactions used in life functions and in maintaining organization is supplied.
- K. Know that DNA, the genetic material, contains all of the information needed for cell function and that it duplicates prior to any cell division.
- L. Understand how the information coded in DNA is used to produce both the proteins that form cellular structure and the enzymes that direct cellular metabolism, thus determining the phenotypic characteristics of the organism.
- M. Know that mutations are alterations in DNA that result in new genetic information.
- N. Understand how mitosis produces new cells with exactly the same chromosomal content as the parent cell and why this is important to development and growth.
- O. Understand how meiosis reduces the number of chromosomes by one half to form gametes.
- P. Be able to discuss some of the new developments in gene technology.
- Q. Understand the physical basis for the inheritance of genetic traits.
- R. Understand the necessity of nomenclature and classification systems in presenting an orderly study of diversity.

- S. Recognize the subcellular nature of viruses.
- T. Recognize the general characteristics of all bacteria and distinguish among the principal types of bacteria.
- U. Recognize the general characteristics of all protists and distinguish between each of the major protist groups.
- V. Recognize the general characteristics of all fungi and distinguish between the major fungi groups.

III. COURSE OBJECTIVES

The student will be required to demonstrate that he has attained each general course competency by performing the objectives listed under each competency.

- A. Understand the application of the scientific method in biology.
 - 1. List the steps in the scientific method.
 - 2. Describe experiments that exemplify the scientific method.
- B. Understand the principle differences that separate the biota and the abiota.
 - 1. List the characteristics unique to life on planet earth
- C. Understand the theories of origin of life on earth.
 - 1. List the various testable theories of origin of life; give the evidences which support these theories.
- D. Know that all matter, including that making up living organisms, is composed of chemical units with characteristic structures and properties at each level of organization.
 - 1. Differentiate among atoms, elements, and molecules.
 - 2. Describe and sketch the Bohr model of an atom, using the terms proton, neutron, electron, nucleus, orbitals and energy level or shell.
 - 3. Using appropriate examples, explain how ionic, covalent and hydrogen bonds are formed; their relative energy requirements; and their biological importance.
 - 4. Interpret chemical equations using these terms; reactants, products, and direction of reaction.
 - 5. Explain the role of chemical reactions (metabolism) in living things.
 - 6. Describe the special properties of water that make it a suitable medium for life.
 - 7. Define the following terms: atom, atomic nucleus, proton, neutron, electron, atomic number, atomic weight, ion, ionic bond, electrostatic attraction, molecule, acid, base, pH, buffer, covalent bond (polar and non-polar), hydrogen bond.
- E. Know the general structures of the four groups of macromolecules and the major functions of each group in organisms and be able to give examples of each.
 - 1. By labeling diagrams of each of the four classes of biologically important organic molecules; identify their general structures; identify the building blocks of each group and identify the major bond types in each.
 - 2. Identify the basic structural differences among the molecules in each of the following groups: fatty acids, amino acids, nucleotides.

3. Differentiate among the various levels of protein structure--primary, secondary, and tertiary.
 4. Given 8-12 nucleotides, construct a molecule of DNA and label the hydrogen bonds, complementary base pairs, and sugar phosphate linkages.
 5. Compare RNA nucleotides to DNA nucleotides and DNA molecules to RNA molecules on the basis of composition and structure.
 6. Identify a reaction as degradation or synthesis (dehydration or hydrolysis); anabolic or catabolic.
 7. Explain the importance of the above reaction types to organismal metabolism.
 8. Define the following terms: functional group, amino group, fatty acid, disaccharide, carboxyl group, polysaccharide, amino acid, protein, polypeptide, carbohydrates, DNA, peptide bond, nucleic acids, glycerol, nucleotide, lipids, RNA and monosaccharide.
- F. Recognize the role of cells in organisms and understand why and how a cell interacts with its environment, including other cells.
1. State the cell theory.
 2. Use specific examples to describe the active and passive regulation of the passage of materials by a plasma membrane, including both the mechanisms and the structures involved in that regulation.
 3. Draw a diagram of the fluid-mosaic model of the cell membrane, labeling the hydrophobic and hydrophilic portions of the phospholipids, the proteins and the carbohydrates.
 4. Predict what will happen when a cell is placed in solutions of varying concentrations of solutes.
 5. Define the following terms: diffusion, osmosis, dialysis, facilitated diffusion, osmotic pressure and potential, hypertonic, hypotonic, isotonic, transmembrane channel proteins, endocytosis, exocytosis, phagocytosis, pinocytosis and receptor mediated endocytosis.
 6. Identify and define proteins of plasma membranes which are used as cell surface receptors, self identify markers, adhesion proteins and anchoring proteins.
 7. What is meant by turgor pressure and which type of cells have turgor pressure?
 8. Define the following types of active transport: uniport, cotransport, symport and antiport.
 9. Define the following types of cell signals autocrine, paracrine, endocrine and synaptic (neurotransmitters).
 10. How are G-protein linked molecules used within cell membranes and how are Ca^{++} and cAMP used within the cytoplasm of cells?
 11. Be able to describe the following types of cell to cell junctions and give the function of each: anchoring junctions, desmosomes, tight junctions, adherens junctions, gap junctions and plasmodesmata.
- G. Differentiate between prokaryotic and eukaryotic cells.
1. List the differences between prokaryotic and eukaryotic cells.
- H. Describe the intercellular structure of a eukaryotic cell.
1. Define the following terms: plasma membrane, organelles, cell wall, cytoplasm, chromosomes, nucleus, eukaryotic cell, chromatin, prokaryotic cell, nucleolus, ribosome, genes, endoplasmic reticulum, mitochondria, nuclear membrane, lysosomes, chloroplasts, Golgi apparatus, chlorophyll, flagella, plastids, vacuoles, cilia and microtubules.

- I. Understand the diversity of life at the various levels of organization.
 - 1. Discuss basic differences among organisms in the six major Kingdoms of life.
- J. Understand how the energy required to drive various chemical reactions used in life functions and in maintaining organization is supplied.
 - 1. Be able to state and explain the first and second laws of thermodynamics.
 - 2. Be able to define entropy.
 - 3. Use labeled diagrams to explain the ADP-ATP cycle's role in supplying energy for cells.
 - 4. Explain why the 3 dimensional structure of an enzyme is the key to its activity. Use the terms active site, and substrate.
 - 5. Explain the role an enzyme plays in speeding up a chemical reaction.
 - 6. Relate the importance of changes in temperature, pH and concentrations to enzyme function.
 - 7. Be able to define a metabolic pathway.
 - 8. Be able to define the following: substrate, cofactor, coenzyme, active site, allosteric site noncompetitive and competitive inhibitions and substrate-enzyme complex.
 - 9. Given a list of photosynthetic or cellular respiration events, order them from original energy source (sun) to useful cellular energy (ATP).
 - 10. Explain why organisms depend directly or indirectly on photosynthesis to satisfy their energy needs.
 - 11. Explain the role of the following in photosynthesis: water, electrons, CO₂, H₂O, energy.
 - 12. Follow the movement of the following through noncyclic photophosphorylation and the Calvin-Benson cycle: electrons CO₂, H₂O energy.
 - 13. Name the products and describe their fate in noncyclic photophosphorylation and the Calvin-Benson cycle.
 - 14. Write the summary equations for the light reactions, the dark reactions, and photosynthesis.
 - 15. Indicate what happens to a substance when it is oxidized or reduced.
 - 16. Explain why organisms depend upon cellular respiration for energy.
 - 17. Explain the role of the following in respiration: glucose, O₂, redox reactions, oxidative phosphorylation, ATP.
 - 18. Write summary equations for fermentation, glycolysis, bridge step, Krebs cycle and the ETC cellular respiration and be able to trace carbon, hydrogen and oxygen through each stage.
 - 19. Know the importance of biological catalysts in the overall transfer of energy in living things.
- K. Know that DNA, the genetic material, contains all of the information needed for cell function and
 - 1. Given a sequence of bases on one DNA strand, give the sequence on the complementary strand.
 - 2. Given a molecule of DNA, show replication into two new molecules, indicating the original strands and newly synthesized strands. Identify nucleosomes.
- L. Understand how the information coded in DNA is used to produce both the proteins that form cellular structure and the enzymes that direct cellular metabolism, thus determining the phenotypic characteristics of the organism.

1. List the bases in DNA and RNA as complementary pairs and explain the chemical basis for the pairing.
 2. Identify the following DNA polymerase, ligase, primase, RNA primer, okazaki fragments and initiator proteins.
 3. List three types of RNA and indicate the function of each.
 4. Given a sequence of bases on DNA, transcribe RNA from them, translate this into a polypeptide chain and, using a codon dictionary, identify the amino acids in the polypeptide.
 5. Describe in detail by using a diagram or by listing events in order, the process of protein synthesis, using the terms: translation, transcription, codon, anticodon, mRNA, rRNA, tRNA, amino acids, peptide bonds and polypeptide.
 6. Tell where the events listed above (replication, transcription, and translation) occur, and explain the purpose of each.
 7. Define the following terms: introns, exons and spliceosomes.
- M. Know that mutations are alterations in DNA that result in new genetic information.
1. List examples of several types of mutations and possible causes of mutations or mutagenic agents.
- N. Understand how mitosis produces new cells with exactly the same chromosomal content as the parent cell and why this is important to development and growth.
1. Distinguish between the following: mitosis and cytokinesis, plant and animal cell mitosis, chromatid and chromosome.
 2. Given the chromosome number of a cell, specify the number of chromatids and centromeres in each stage of mitosis.
 3. Given a chromosome with genes on it, sketch the dyad that it forms, labeling chromatids, centromere, and the genes on the chromatids.
 4. Identify the following time periods during the cell cycle and tell what events occur during each: G₁, S, G₂, M and C.
- O. Understand how meiosis reduces the number of chromosomes by one half to form gametes.
1. Describe the principal events that occur during each stage of mitosis. Use a diagram to illustrate your description, naming each stage and labeling the poles, equator, spindle fibers, dyads, and daughter cells.
 2. Given a list of alleles, sketch a tetrad and place the following alleles in a correct relative position on the tetrad.
 3. List the stages of meiosis and describe the principal events that occur during each stage.
 4. Given a cell with four chromosomes (two homologous pairs: A,a; B,b:), diagram meiosis.
 5. Define gametogenesis and differentiate between oogenesis and spermatogenesis.
 6. Compare mitosis and meiosis on the basis of the following:
 - a. role in the life cycle of an organism.
 - b. the behavior of chromosomes in meiosis I and in mitosis.
 - c. the behavior of chromosomes in meiosis II and in mitosis.
 - d. the end products of each.
 7. Know that sexual reproduction increases variation in the population by making possible genetic recombination.
 8. Given the cell above, explain how randomness in chromosome segregation during Anaphase I

- will result in four different possible combinations of chromosomes in the haploid gametes.
9. Discuss variation as the major advantage of sexual reproduction. Relate crossing-over and recombination to variation.
- P. Be able to discuss some of the new developments in gene technology.
1. Define recombinant DNA. Discuss the role of restriction enzymes and plasmids in recombinant DNA technology.
 2. Be able to define the following: DNA techniques Gel electrophoresis, polymerase chain reactions, southern blotting, northern blotting and RFLPs.
- Q. Understand the physical basis for the inheritance of genetic traits.
1. Define gene and describe its chemical composition.
 2. Explain the relationship of DNA to genes, genes to chromosomes and chromosomes to meiosis.
 3. Know the laws governing the inheritance of traits which follow Mendelian inheritance patterns and use the principles of meiosis to explain them.
 4. State Mendel's Law of Segregation and explain its meaning by relating it to the formation of gametes in a mitotic example.
 5. State Mendel's Law of Independent Assortment and explain its meaning by relating it to the formation of gametes in a meiotic example using at least two gene pairs.
 6. Solve problems involving one factor crosses with: complete dominance, incomplete dominance, sex-linkage and multiple alleles.
 7. Explain how partial dominance differs from complete dominance and compare the results when one allele is dominant over another with the results when there is partial dominance (incomplete dominance).
 8. Explain how sex is determined genetically in humans and use your explanation to explain why recessive sex-linked characters are expressed more often in males than in females.
 9. Define the following terms: dominant allele, recessive allele, parents, F_1 , F_2 , P, locus (loci), gene, homozygous, heterozygous, allele, monohybrid cross, test cross, phenotype, somatic cells, dihybrid cross, partial (incomplete) dominance, X chromosome, multiple alleles, Punnet square, genotype, Y chromosome, sex chromosome, autosome and sex-linked characteristics.
- R. Understand the necessity of nomenclature and classification systems in presenting an orderly study of diversity.
1. Explain the advantage of binomial nomenclature.
 2. State the order of the classification hierarchy.
 3. Characterize the six kingdoms.
- S. Recognize the subcellular nature of viruses.
1. Describe the structure and reproductive cycles of viruses. (lytic vs. lysogenic)
 2. List some major viral diseases.
 3. Describe the classification of viral groups based on their type of nucleic acid.

- T. Recognize the general characteristics of all bacteria and distinguish among the principal types of bacteria.
1. Explain bacterial growth rate.
 2. Name the different bacterial shapes and arrangements.
 3. Give examples of beneficial and detrimental activities of bacteria on humans.
 4. Define the following terms: taxonomy, binomial nomenclature, phylogeny, microorganism, pathogen, Gram stain, pili, plasmid, endospores, cell wall, capsule, methanogens, halophiles, bacteriophage, capsid.
- U. Recognize the general characteristics of all protists and distinguish each of the major groups of protists..
1. List the ways protists differ from bacteria.
 2. Compare protists with other eukaryotes.
 3. List the major intestinal and blood protozoan pathogens and the diseases they cause.
 4. Describe the different patterns of reproduction found among the protists.
- V. Recognize the general characteristics of all fungi and know the major groups of fungi.
1. Describe the various types of fungal body plans and patterns of reproduction.
 2. Name one specific example of each of the major groups of true fungi.
 3. Name the two organisms which form the mutualistic relationship known as lichens.
 4. Define the following terms: mycelium, hypha, spore, sporangium, saprobe, parasite, symbiosis, mutualism, lichen.

IV. CLASS ACTIVITIES

- A. Lecture.
- B. A-V self instruction.
- C. A-V classroom instruction.
- D. Weekly laboratory exercises.

V. CRITERIA FOR EVALUATION

The student will have demonstrated attainment of the general course competencies if he accumulates a total of 70 percent of the points possible from the following criteria:

- A. Scheduled lecture examinations.
- B. Laboratory examinations.
- C. The student will pass course with 60% accuracy.

Date Adopted: 1999
Date Reviewed: 2001
Date Revised: 1998, 2001,2003

<u>BIO</u>	<u>104</u>	<u>PRINCIPLES OF BIOLOGY II</u>	<u>BIOLOGY 103</u>
Prefix	No.	Course Title	Prerequisite

Credit Hours: 4 Contact Hours: Lecture 3 Laboratory 3

I. COURSE DESCRIPTION

This is an introduction to basic principles of evolution and a survey of plant and animal diversity including classification, morphology, physiology and reproduction and the fundamental principles of ecology. Laboratory is required.

II. GENERAL COURSE COMPETENCIES AND OBJECTIVES

Upon successful completion of BIO 104, the student should have at least 70% mastery of the following competencies.

The student should be able to:

- A. Be able to state the conditions necessary for evolution to occur.
- B. Be able to discuss the evidences for evolution.
- C. Be able to define what a species is, how speciation occurs and isolating mechanisms..
- D. Be able to trace the evolutionary lineage of Homo sapiens..
- E. Recognize and classify common examples of each major animal phylum.
- F. Discuss organic evolution among the various animal groups and develop an understanding of the phylogenetic relationships between the major animal phyla.
- G. Describe anatomical parts used to carry out life functions within selected individuals from each major phylum and develop an understanding of how environmental conditions can modify these structures.
- H. Describe the ecological habitat each major animal group prefers and the niches that they fill.
- I. Discuss the economic impact the various animal groups have on mankind.
- J. Be familiar with the principles and practices of botanical taxonomy and classification.
- K. Recognize both the diversity and the relationships that exist among the organisms commonly grouped together as “plants”: cyanobacteria, algae, fungi, bryophytes and vascular plants.
- L. Recognize typical plant structures and their functions in plants.
- M. Understand the following general functions that must be performed by plants in order to maintain life: metabolism, growth and reproduction.
- N. Recognize the importance of plants to man and the environment.

III. COURSE OBJECTIVES

The student will be required to demonstrate that he has attained each general course competencies by performing the objectives listed under each competency. The student should be able to:

- A. State the conditions necessary for evolution to occur.
 1. Be able to distinguish between acquired characteristics vs. natural selection.
 2. Be able to discuss the need for genetic variation..
 3. Be able to relate changing environmental conditions and time to the process of evolution.
 4. Be able to discuss the role of competition to the evolutionary concept.
 5. Be able to work Hardy-Weinberg problems.
 6. Be able to relate how mutations, non-random mating and gene flow can effect evolution.
 7. Know what is meant by the founder effect and the bottleneck effect in relation to genetic drift.
 8. Be able to recognize examples of the following forms of selection: disruptive, directional, stabilizing

- B. Discuss the evidences of evolution.
 1. Know the various eras and periods of the geological time table. Be able to give approximate times and important events relative to each.
 2. Be able to discuss the significance of the fossil record and give illustrations of groups which clearly show evolutionary trends.
 3. Discuss Darwin's finches and mammalian life forms found in Australia as example of adaptive radiation.
 4. Be able to discuss artificial selection and domestication as evidence of evolution.
 5. Be able to discuss anatomical features as evolutionary evidence; know what homology and analogy mean as related to anatomical features.

- C. Define what a species is, how speciation occurs and isolating mechanisms.
 1. Define speciation and sympatric vs. allopatric speciation.
 2. Know the significance and give examples of ecological and behavioral isolation.
 3. Give examples of geographical isolation.
 4. Be able to list and define both prezygotic and postzygotic isolating mechanisms.
 5. Be able to discuss the role of polyploidy in plant evolution.
 6. Know the difference between punctuated equilibria and gradualism theories of evolutionary rates.

- D. Trace the evolutionary lineage of Homo sapiens.
 1. Know who the Prosimians are as well as the difference between the following groups: Anthropoids, Hominoids and Hominids
 2. Know the features of primates important to the development of modern man.
 3. Be able to distinguish a new world monkey from an old world monkey anatomically.
 4. Be able to trace the lineage of Homo sapiens from the first Hominid to today's form.

- E. Recognize and classify common examples of each major animal phylum.
1. List the major taxa used in the animal kingdom.
 2. State the major rules of nomenclature and apply them to hypothetical situations.
 3. Be able to recognize and correctly place examples of each of the following animals into the correct phyla:

a. Porifera	h. Annelida
b. Cnidaria	i. Arthropoda
c. Ctenophora	j. Echinodermata
d. Platyhelminthes	k. Chordata
e. Nematoda	
f. Rotifera	
g. Mollusca	
 4. Be able to correctly place examples of the following phyla into the correct class (and/or correct subphyla):

a. Cnidaria	e. Arthropoda
b. Platyhelminthes	f. Echinodermata
c. Mollusca	g. Chordata
d. Annelida	
- F. Discuss organic evolution among the various animal groups and develop an understanding of the phylogenetic relationships between the major animal phyla.
1. Identify the metazoa.
 2. Discuss the syncytial and colonial flagellate theories of metazoan evolution including the pros and cons of each theory.
 3. Describe the various types of symmetry and be able to recognize examples of each.
 4. Describe the differences in embryonic development between diploblastic and triploblastic organisms. Also, be able to label the various germ layers, ectoderm, mesoderm and endoderm.
 5. Be able to construct a cladogram for all of the phyla listed in A. 3 above.
- G. Describe anatomical parts used to carry out life functions within selected individuals from each major phylum and develop an understanding of how environmental conditions can modify these structures.
1. Identify the following morphological parts on a sponge: osculum, spicules, mesenchyme, spongocoel, gemmules, base, choanocytes, pores, epidermis, incurrent canals, and gastrodermis.
 2. Relate how sponges feed, respire, excrete nitrogenous wastes, react to environmental stimuli, and reproduce both sexually and asexually.
 3. Identify the following anatomical features on the examples listed:
 - a. Obelia medusa: tentacle, mouth, manubrium, ring canal, gastrovascular cavity: Obelia polyp feeding polyp and reproducing polyp..
 - b. Aurelia: epidermis, gastrodermis, mesoglea, tentacles, cnidoblasts, nematocysts, canals, gonads, oral end and aboral end.
 - c. Hydra: base, gastrovascular cavity, epidermis, hypostome, tentacles, cnidoblasts, nematocysts, gonads, mesoglea and oral end.

- d. Metridium: epidermis, gastrodermis, mesoglea, septa, base, oral end, aboral end, cilia, siphonoglyph, acontia, gonads and gastrovascular cavity.
4. Tell how Cnidarians feed, respire, excrete nitrogenous wastes and reproduce, both sexually and asexually.
5. Identify Pleurobrachia.
6. Describe the difference between acoelomates, pseudocoelomates and coelomate animals. Identify the following areas on a bilaterally symmetrical animal: dorsal, ventral, anterior, posterior, lateral, medial, proximal, cross section and longitudinal section.
7. Identify the following morphological parts on each example listed below:
 - a. Planarian: eyespots, flame cells, auricles, pharynx, mouth, intestines.
 - b. Clonorchis sinensis: mouth, pharynx, intestine, oral sucker, ventral sucker, ovaries, oviduct, uterus, vagina, yolk gland, testis, vas deferens, and gonopore (genital pore).
 - c. Taenia pisiformis: scolex hooks, suckers, strobila, proglottides (immature, mature, gravid).
8. Give the means of feeding, respiration, excretion, reaction to stimulation, and reproduction both sexual and asexual for the platyhelminthes.
9. Identify the following morphological parts on Ascaris lumbricoides in both longitudinal and cross sections: mouth, epidermis, pharynx, longitudinal muscle, anus, pseudocoel, ovaries, intestine, oviducts, uterus and vagina.
10. Identify the following anatomical parts on rotifers: pseudocoel, corona, cilia, pharynx, mastax, foot.
11. Distinguish between a complete and an incomplete digestive system.
12. Describe rotifers as to their feeding habitat preferences, respiration, excretion, stimuli and reproduction both sexually and asexually.
13. Identify the morphological parts on the individual listed below.
 - a. Chitin: valve, mantle, pallial groove, foot, head, gills and anus.
 - b. Bivalve: right valve, left valve, mantle, foot, gills, labial palps, anterior adductor muscle, posterior adductor muscle, excurrent siphon, incurrent siphon, umbo, periostracum, prismatic, nacre, hinge tooth, hinge ligament, mouth, digestive gland, gonad, intestine, pericardial sinus and heart.
 - c. Snail: valve, head, tentacles, anus, gonopore, mouth, radulla, lung ovotestis, oviduct, vagina, seminal receptacle, dart sack, penis, heart, coelom and mantle.
 - d. Squid: head, foot, mantle, pen, siphon, tentacles, arms, mouth, beak, gonad, ink sac, digestive gland, and gills.
14. Identify the morphological parts listed for each example below:
 - a. Earthworm (Lumbricus): prostomium, mouth, somites, clitellum, sperm grooves, anus, setae, pharynx, esophagus, crop, gizzard, intestine, heart (aortic arch), dorsal blood vessel, nephridium and septa.
Cross-section: cuticle, epidermis, circular muscle, longitudinal muscle, coelom, intestine, typhlosole, chlorogogen tissue, dorsal blood vessel, ventral blood vessel, ventral nerve cord, giant nerve fibers.
 - b. Sandworm (Nereis): prostomium, peristomium, mouth, tentacles, jaws, parapodia, somites and anus.
Cross-section: parapodium, epidermis, intestine, mesentery, nephridium, and ventral nerve cord.
 - c. Leech (Hirudio): posterior sucker, mouth, pharynx, crop, ceca, intestine, anus, somites.

15. Describe how annelids feed, respire, excrete nitrogenous wastes, react to stimulation and reproduce both sexually and asexually.
16. Give the characteristics that are unique to the arthropods.
17. List the information requested below for members of each arthropod class.
Body regions, number of antennae, number of legs, type of mouth parts, means of respiration, type of development and principle habitat.
18. Identify the morphological parts listed below:
 - a. Grasshopper: head, thorax, abdomen, labrum, labium, mandible, maxilla, compound eye, spiracle, tympanum, wings, legs, mouth, pharynx, esophagus, crop, gizzard, stomach, intestine, rectum, anus, gonad, heart, hemocoel, ventral nerve cord, ganglion, brain and malpighian tubules.
 - b. Crayfish: rostrum, antennae, compound eyes, carapace, cephalothorax, abdomen, telson, uropods, walking legs, cheliped, mandible, 2 pairs of maxilla, 3 pairs of maxillipeds, sex of individual, mouth, pharynx, stomach, intestine, anus, green glands, heart, gonads, digestive gland, gills, ventral nerve cord, ganglion and brain.
 - c. Spider: cephalothorax, abdomen, fangs, ocella, spinnerets, anus, legs and book lungs.
19. Describe the water vascular system of the echinoderms and tell how it is used in locomotion and feeding.
20. Discuss how members of the various classes of echinoderms feed, respire, remove wastes and reproduce.
21. Identify the anatomical parts listed for each organism:
 - a. Starfish: arms (rays), central disk, oral surface, aboral surface madreporite, stone canal, radial canal, ring canal, ampulla, tube feet, ambulacral groove, gills, pedicellariae, mouth, stomach, gonad and digestive glands.
 - b. Sea urchin: mouth, Aristotle's lantern, tube feet, spines, ossicles, gonads and digestive gland.
22. Describe the 3 unique Chordate characteristics and list the various subphyla of Chordates.
23. Identify the following parts on Amphioxus.
Longitudinal Section: dorsal fin, oral hood, cirri, mouth (Buccal cavity), pharynx, gill bars, gill slits, endostyle, intestine, liver (digestive gland), anus, atrium, atriopore, gonad, brain, nerve cord, notocord, myosepta and myotomes (myomeres).
Cross-Section: dorsal fin, myomeres, myosepta, coelom, pharynx, gill bars, gill slits, endostyle, digestive gland, gonads and metapleural folds.
24. List the unique characteristics of vertebrates.
25. Describe the lampreys as to their: means of feeding, means of respiration, removal of nitrogenous wastes, level of behavior.
26. List the characteristics of Cyclostomata that make them primitive vertebrates.
27. Identify the following structures of the chondrichthyes: spiracle, pectoral fins, pelvic fins, claspers, heterocercal tail, lateral line and placoid scales.
28. Describe the following parts found within an example of Osteichthyes: premaxilla, maxilla, mandible, operculum, nostril, lateral line, pectoral fins pelvic fins, anal fin, dorsal fin, caudal fin, scales, mouth pharynx, gill, gill bar, gill raker, gill filament, swimbladder and stomach.
29. Identify the following parts on the frog: musculature, ventral side, myohyoid, deltoid, pectoralis, external oblique, rectus abdominis, linea alba, triceps femoris, adductor longus, sartorius, adductor magnus, gracilis major, musculature, dorsal side, deltoid, longissimus dorsi, latissimus dorsi, triceps femoris, gluteus, semimembranosus, gracilis minor, gastrocnemius, tibialis anticus, tibialis posticus, semitendinosus, peroneus and tendon of Achilles.

- Internal anatomy: heart, right atrium, left atrium, ventricle, lungs, mouth, tongue, liver, stomach, small intestine, large intestine, urinary bladder, mesentery, gall bladder, pancreas, spleen, ovary, kidney, oviduct, fat body, and colon.
30. List 2 characteristics by which amphibians and reptiles may be separated.
 31. Identify the following parts found in some reptiles: carapace, Jacobsen's organ, plastron and hemipenes.
 32. Give a unique feature of birds.
 33. List 10 modifications in birds that are important for flight.
 34. Discuss the difference between altricial and precocial young birds.
 35. Give 2 features considered necessary to have a homoeothermic life style.
 36. List the unique characteristics found in mammals.
 37. List the 4 major types of teeth found in mammals and give their function.
- H. Describe the ecological habitat each major animal group prefers and the niches that they fill.
1. Know the role of the Poriferans, cnidarians and Ctenopharans within aquatic habitats and describe the relative abundance of each group.
 2. Discuss the parasitic Platyhelminthes and nematodes.
 3. Know the role of earthworms in terrestrial habitats and the Polychaetes within aquatic habitats.
 4. List the various classes of mollusks and describe their habitat requirements.
 5. List the various classes of arthropods and describe their habitat preferences.
 6. Describe the role of the major Echinoderm groups within their marine habitat.
 7. Discuss the habitat preferences of the various vertebrate groups.
- I. Discuss the economic impact the various animal groups have on mankind.
1. Discuss the significance of the parasite Platyhelminthes and nematodes to man.
 2. Describe the impact earthworms have in soil development, maintenance and fertility.
 3. Describe the mollusks that are beneficial and harmful to man.
 4. Discuss the financial losses caused by arthropods, particularly insects.
 5. Discuss the beneficial arthropods and how man uses them.
 6. Define the significance of each vertebrate group to man.
- J. State the principles and practices of botanical taxonomy and classification.
1. Define the following terms: kingdom, phylum (division), class, order, family, genus, species.
 2. Explain the assumptions that form the basis for our present phylogenetic system.
 3. Rank the following in terms of increasing or decreasing relationship: class, phylum, family, kingdom, order and species.
- K. Recognize both the diversity and the relationships that exist among the organisms commonly grouped together as "plants": cyanobacteria, algae, fungi, bryophytes and vascular plants.
1. Discuss the phylogenetic relationships that exist among the groups listed above.

- L. Recognize typical plant structures and their functions in plants.
1. Recognize the following structures and their functions in plant cells: cytoplasm, nucleus, mitochondria, endoplasmic reticulum, microtubules, flagella, vacuoles, cell wall, plasmodesmata, plastids.
 2. Describe the following tissues and their roles in plants: apical meristem, collenchyma, parenchyma, sclerenchyma, xylem, phloem, epidermis, periderm.
 3. Differentiate between simple and complex tissues.
 4. Describe the following tissue systems found in plants; identify them as simple or complex: ground, dermal, vascular.
 5. Identify the following and their roles in the plants in which they are found:
 - a. Bryophyta: gametophyte, sporophyte, archegonia, egg, sperm, antheridia, capsule, operculum, rhizoids, protonema, neck cells, thallus, gametes
 - b. Pterophyta: gametophyte, sporophyte, rhizomes, sperm, archegonia, egg, prothallia, sori, foot, sporangia, annulus, spores, antheridia
 - c. Coniferophyta: leaves, cones (pistillate or staminate), pollen
 - d. Anthophyta: leaves- blade, petiole, stipules, veins, leaflets, epidermis, cuticle, stomata, guard cells, palisade and spongy cells, mesophyll.
roots- root cap, apical meristem, epidermis, pericycle, vascular cylinder, cortex, endodermis, xylem, phloem, vascular cambium, root hairs, regions of elongation, maturation and division.
stems- epidermis, phloem, xylem, vascular cambium, cortex, pith, bark, terminal bud, bud scales, lenticels, internodes, nodes, lateral buds, leaf scars.
flowers- sepal, petals, stamen, anthers, filament, carpel ovary, stigma, style, ovule receptacle, pollen grain, pollen sac.
seeds- epicotyl, hypocotyl, cotyledon, seed coat, embryo, scutellum, endosperm.
 6. Differentiate among and recognize examples of the following: roots- taproot and fibrous root; monocot and dicot; primary, secondary, and adventitious.
leaves- simple and compound; pinnate and palmate; net and parallel venation.
stems- monocot and dicot (herbaceous, woody).
flowers- zygomorphic and actinomorphic; perfect and imperfect; complete and incomplete.
seeds- monocot, dicot.
- M. Understand the general functions which must be performed by plants in order to maintain life: metabolism, growth and reproduction.
1. Metabolism
 - a. List the major functions of stems, roots and leaves, and the contribution of each to the maintenance of life.
 - b. Discuss the significance of photosynthesis to organisms.
 - c. Explain the photosynthetic pathways, using labeled diagrams and including the following: cyclic and noncyclic photophosphorylation, light reactions, dark reactions, Calvin-Benson (C-3) pathway, (C-4) CAM, PEP pathways, redox rx, pigments, photosystems.
 - d. Trace the movements of the following through the photosynthetic pathways: electrons, energy, H, CO₂, O₂.
 - e. Compare and contrast the following pathways: cyclic and noncyclic photophosphorylation; C-3 and C-4 pathways; light and dark reactions.
 - f. List the macronutrients required by plants and the general roles of inorganic nutrients in plants.

- g. Define transpiration and discuss its significance.
 - h. Explain the movement of water through a plant, using the following terms: transpiration stream, guttation, root pressure, adhesion-cohesion-tension theory.
 - i. Explain the movement of organic materials through plants using the following terms: assimilate stream, source, sink, pressure-flow hypothesis, phloem, active transport, passive transport, bulk flow.
2. Growth
- a. Define the following: annual, biennial, perennial, wood, bark, growth rings, germination, dormancy, apical dominance, hormone. Differentiate between primary and secondary growth and indicate how each affects the size of a plant.
 - b. Discuss dormancy: causes, advantages, ways to break it.
 - c. Explain how the following factors are involved in germination: water, oxygen, temperature.
 - d. Discuss the relationship of following survival phases of a plant life cycle : multiplication, dispersal, assimilation, genetic variation.
 - e. Describe or discuss life cycles from the following groups and relate them to the four survival phases: moss, liverworts, ferns and angiosperms.
 - f. Begin with the apical meristem and ending with the secondary tissues produced during the first year's growth, trace the development of the stem, indicate the origin of each region in the discussion.
 - g. Begin with the apical meristem and end with the secondary tissues produced during the first year's growth, trace the development of the root; indicate the origin of each region in the discussion.
 - h. Explain how annual rings are formed.
 - i. Discuss the actions of hormones in general.
 - j. Describe the sources and effects of the following hormones: auxins, cytokinins, ethylene and gibberellins.
 - k. Define the following terms: tropisms, circadian rhythms, long-day plants, short-day plants, day-neutral plants, photoperiodism.
 - l. Discuss the chemical basis for photoperiodism.
 - m. Given a specific environmental condition, predict how the plant will respond and explain why it will respond this way.
- N. Recognize the importance of plants to man and the environment.
- 1. Discuss the roles played by green plants in the environment.
 - 2. Discuss the economic importance of the following groups: bryophytes, ferns, gymnosperms and angiosperms.

IV. CLASS ACTIVITIES

- A. Lecture.
- B. A-V self instruction.
- C. A-V classroom instruction.
- D. Weekly laboratory exercises.

V. CRITERIA FOR EVALUATION

The student will have demonstrated attainment of the general course competencies if he accumulates a total of 70 percent of the points possible from the following criteria:

- A. Scheduled lecture examinations.
- B. Laboratory examinations.
- C. The student will pass course with 70% accuracy.

Date Revised: 1980
Date Revised: 1985
Date Revised: 1985, 1998, 2002

<u>BIO 202</u>	<u>HUMAN ANATOMY AND PHYSIOLOGY II</u>	<u>BIO 201</u>
Prefix No.	Course Title	Prerequisite

Credit Hours: 4 Contact Hours: Lecture 3 Lab 2

I. COURSE DESCRIPTION

This course is the second in a two-semester sequence that examines the structure (anatomy) and function (physiology) of the human body. Topics in BIO 202 include the endocrine, cardiovascular, lymphatic, immune, respiratory, digestive, urinary, and reproductive systems. Dissection, histological studies, physiology experiments, and computer-simulated activities are featured in the required lab.

II. GENERAL COURSE COMPETENCIES

- A. The student will demonstrate knowledge of the detailed anatomy of each system studied.
- B. The student will demonstrate knowledge of the physiological concepts related to each system studied.
- C. The student will acquire an understanding of the principle of complementarity, as well as, an understanding of the concept of a holistic organism functioning to maintain homeostasis.

III. COURSE OBJECTIVES

The student will be required to demonstrate that he has attained each general course competency for the systems studied in this course by performing the objectives listed under each body system.

- A. Endocrine System
 - 1. Define the functions of the endocrine system.
 - 2. Compare the endocrine system to the nervous system as a control for body functions by identifying the targets, messengers, and response time of each.
 - 3. Understand the difference between an endocrine gland and an exocrine gland.

4. Describe the four general types of regulation for hormonal secretion.
5. Discuss the negative feedback mechanism as it relates to the control of hormonal activity.
6. Describe the difference in the structure of amino acid-based hormones and steroid hormones.
7. Explain the mechanisms of hormone action.
8. Identify the location and structure of each gland.
9. List the hormones secreted by each gland.
10. Know the structure, target, action and control of each major hormone.
11. Give examples of homeostatic interrelationships between the endocrine system and other body systems.

B. Cardiovascular System

1. List the functions of the blood.
2. Identify the components of plasma.
3. Identify the major plasma proteins and the function of each.
4. Describe the structural and functional characteristics of the formed elements of the blood.
5. Know the chemical composition of hemoglobin.
6. Describe the regulation and requirements for erythropoiesis.
7. Discuss ABO blood typing and transfusion incompatibilities.
8. Explain hemolytic disease of newborns and its relationship to the Rh factor.
9. Describe the steps in hemostasis.
10. Use a flow chart to diagram the blood clotting mechanism.
11. Describe the size, location, and orientation of the heart.
12. Identify the structures of the heart, including valves, chambers and associated great vessels.
13. Diagram the route of blood flow through the heart, including the pulmonary and systemic circuit.
14. Compare the structural and functional differences of cardiac and skeletal muscle.
15. Describe the mechanism and events of cardiac muscle contraction.
16. Name the components of the conduction system of the heart and trace the conduction pathway.
17. Draw a normal electrocardiogram tracing and label the individual waves and line segments.
18. Describe the sequence of events of the cardiac cycle.
19. Discuss the effects of various factors on cardiac output.
20. Explain the role of the autonomic nervous system in regulating cardiac output.
21. Compare and contrast the structure and function of arteries and veins.
22. Describe the structure and function of a capillary bed.
23. Define vasodilation and vasoconstriction.

24. Explain the relationship between blood flow, blood pressure and resistance.
25. Describe the mechanisms of blood pressure regulation.
26. Discuss neural, hormonal, and chemical factors that affect blood pressure.
27. Name and give the location of the major arteries and veins in systemic circulation.
28. Classify the different types of circulatory shock.
29. Give examples of homeostatic interrelationships between the cardiovascular system and other body systems.

C. Lymphatic System

1. Identify the functions of the lymphatic system.
2. Describe the structure and distribution of lymphatic vessels.
3. Identify the source of lymph and trace its route of transport.
4. Describe the location and function of lymph nodes, tonsils, lymphoid organs and other lymphoid structures.
5. Give examples of homeostatic interrelationships between the lymphatic system and other body systems.

D. Immune System

1. Explain the difference between a structural body system and a functional body system.
2. Describe the membrane surface barriers and their protective functions.
3. List the cells involved in non-specific resistance and state the functions of each.
4. Describe in detail the inflammatory process and its role in non-specific resistance.
5. Describe in detail the development and stages of fever.
6. Describe the antimicrobial proteins that are produced during non-specific resistance.
7. Distinguish between non-specific resistance and the immune response.
8. Compare cell mediated immunity and humoral immunity.
9. Define immunocompetence.
10. Understand the role of HLA's in self-tolerance.
11. Compare and contrast the origin, site of immunocompetence, and function of B and T lymphocytes.
12. List the sequence of steps in the immune response.
13. Classify the types of antibodies as to location, size and action.
14. Describe the types of immunity and the method for development of the immunity.
15. Identify the types of hypersensitivity reactions.
16. Know the major autoimmune disorders and the target of the self-antibody.

17. Discuss the etiology, pathogenesis and pathophysiology of AIDS.
18. Give examples of homeostatic interrelationships between the immune system and other body systems.

E. Respiratory System

1. List the functions of the respiratory system.
2. Review the structure of the red blood cell and hemoglobin.
3. Identify the location and structure of the organs of respiration.
4. Trace the bronchial tree from the trachea to the alveolus.
5. Compare type I and type II alveoli as to structure, function and numbers.
6. Define "dust" cells.
7. Describe the mechanics of breathing.
8. Explain and compare the respiratory volumes and capacities.
9. Describe the various pulmonary function tests.
10. Define dead space air.
11. Understand the different pressures involved in the mechanics of breathing.
12. Define atelectasis.
13. State Boyle's Law, Dalton's Law, and Henry's Law and relate each to their involvement in respiration.
14. Know the partial pressures of oxygen and carbon dioxide in systemic and pulmonary circulation, as well as at the alveolar and tissue level.
15. Discuss ventilation-perfusion coupling.
16. Describe the effects of pH, temperature, and pCO₂ on oxygen unloading.
17. Describe carbon dioxide transport in the blood.
18. Discuss the neural controls of respiration.
19. Define hyperventilation and hypoventilation.
20. Understand the types of hypoxia and the causes of each.
21. Give examples of homeostatic interrelationships between the respiratory system and other body systems.

F. Digestive System

1. Describe the functions of the digestive system.
2. Describe the location and function of all organs of digestion.
3. Identify the accessory organs of digestion and their function.
4. Explain the dental formula and differentiate between deciduous and permanent teeth.
5. Describe the composition, function and regulation of saliva.
6. Understand the mechanisms of chewing and swallowing.
7. Discuss structural modifications of the wall of the stomach and small intestine that enhance the digestive process.
8. Describe the composition of gastric juice.

9. Name the cell types responsible for secreting the various components of gastric juice.
10. Discuss the function of hormones produced by the small intestine.
11. State the roles of bile and pancreatic juice in digestion and the regulation of each.
12. List the enzymes involved in chemical digestion and name the food on which they act.
13. Name the end products of the digestion of protein, fat, carbohydrates and nucleic acids.
14. Describe the process of absorption.
15. List the six major nutrient categories.
16. Distinguish between fat and water-soluble vitamins and list vitamins belonging to each group.
17. List minerals essential for health and know important dietary sources of each.
18. Describe deamination and B-oxidation as they relate to energy production.
19. Differentiate between LDL and HDL relative to their structures and roles in the body.
20. Give examples of homeostatic interrelationships between the digestive system and other body systems.

G. Urinary System

1. Identify the location and structure of the accessory organs of the urinary system.
2. Describe the functions of the kidney.
3. Trace blood flow through the kidney.
4. Develop a flow chart to show the flow of urine.
5. Describe the anatomy of a nephron.
6. Distinguish between the vascular portion of a nephron and the tubular portion.
7. Describe the mechanisms of filtration, reabsorption and secretion.
8. Define glomerular filtration rate.
9. Explain the roles of aldosterone and ADH in regulating sodium and water reabsorption.
10. Describe in detail the autoregulatory mechanism of the kidney.
11. Discuss the effects of renin-angiotensin on systemic blood pressure.
12. Calculate the renal clearance of various substances.
13. Explain the formation of dilute and concentrated urine.
14. List abnormal urine components and name the condition associated with each.
15. Describe the fluid compartments and indicate the electrolyte concentration in each.
16. List the consequences of abnormal levels of major electrolytes and know terms associated with excess or deficit of each electrolyte.

17. Discuss the three major buffer systems of the body.
18. Describe the influence of the respiratory system on acid-base balance.
19. Describe the influence of the kidney on acid-base balance.
20. Identify acid-base imbalances, determine cause and the possibility of compensation.
21. Give examples of homeostatic interrelationships between the urinary system and other body systems.

H. Reproductive System

1. Describe the common function of the male and female reproductive systems.
2. Describe the location structure and function of the male reproductive organs and accessory structures.
3. Know the secondary sex characteristics of the male.
4. Discuss the source and function of semen.
5. Review the process of spermatogenesis.
6. Review the target, action, and regulation of testosterone.
7. Describe the location, structure and function of the female reproductive organs.
8. Describe the anatomy of the female external genitalia.
9. Discuss the structure of the mammary glands.
10. Review the process of oogenesis.
11. Describe the regulation of the menstrual cycle.
12. Discuss the physiological effects of estrogen and progesterone.
13. Indicate the infectious agents that cause the sexually transmitted diseases.
14. Describe the significant events of puberty and menopause.
15. Give examples of homeostatic interrelationships between the reproductive system and other body systems.

IV. CLASS ACTIVITIES

- A. Lecture
- B. Laboratory
- C. Multimedia supported exercises and activities
- D. Parallel readings

V. CRITERIA FOR EVALUATION

A student will have demonstrated competency in the course if he/she accumulated a total of 70% of the possible points from the following methods of evaluation; the student may pass the course with 60% accuracy in these same evaluations.

- A. Scheduled lecture examinations.
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- C. Semester final examination

Date Revised: 1980
Date Revised: 1985
Date Revised: 1985, 1998, 2002

<u>BIO 202</u>	<u>HUMAN ANATOMY AND PHYSIOLOGY II</u>	<u>BIO 201</u>
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Credit Hours: 4 Contact Hours: Lecture 3 Lab 2

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19. Describe the influence of the kidney on acid-base balance.
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2. Describe the location structure and function of the male reproductive organs and accessory structures.
3. Know the secondary sex characteristics of the male.
4. Discuss the source and function of semen.
5. Review the process of spermatogenesis.
6. Review the target, action, and regulation of testosterone.
7. Describe the location, structure and function of the female reproductive organs.
8. Describe the anatomy of the female external genitalia.
9. Discuss the structure of the mammary glands.
10. Review the process of oogenesis.
11. Describe the regulation of the menstrual cycle.
12. Discuss the physiological effects of estrogen and progesterone.
13. Indicate the infectious agents that cause the sexually transmitted diseases.
14. Describe the significant events of puberty and menopause.
15. Give examples of homeostatic interrelationships between the reproductive system and other body systems.

IV. CLASS ACTIVITIES

- A. Lecture
- B. Laboratory
- C. Multimedia supported exercises and activities
- D. Parallel readings

V. CRITERIA FOR EVALUATION

A student will have demonstrated competency in the course if he/she accumulated a total of 70% of the possible points from the following methods of evaluation; the student may pass the course with 60% accuracy in these same evaluations.

- A. Scheduled lecture examinations.
- B. Laboratory examinations
- C. Semester final examination

Date Adopted: 1965
Date Reviewed: 1988
Date Revised: 1994, 1998, 2001

<u>BIO</u>	<u>220</u>	<u>GENERAL MICROBIOLOGY</u>	<u>BIO 103 OR APPROPRIATE SCORE ON</u>
Prefix	No.	Course Title	<u>BIOLOGY PLACEMENT EXAM AND A</u>
			<u>COLLEGE-LEVEL CHEMISTRY</u>
			Prerequisite

CREDIT HOURS: 4 CONTACT HOURS: LECTURE 2 LAB 4

I. COURSE DESCRIPTION

This course covers fundamental principles of microbiology including history of microbiology, cell structure, and function, microbial genetics, infectious diseases, and immunity. Emphasized topics are the distribution, physiology, culture, identification, classification, and role in nature and medicine, and disease control of microorganisms.

II. GENERAL COMPETENCIES

- A. To enable the student to develop the ability to characterize microorganisms and to understand their function in various environments.
- B. To enable the student to comprehend the sources of microorganisms and various relationships to man and the environment.
- C. To enable the student to understand the basis of infection, disease, control of microorganisms, and the body's defenses against infection.
- D. To enable the student to understand the importance of metabolism and genetics in microorganisms.

III. COURSE OBJECTIVES

- A. To enable the student to develop the ability to characterize microorganisms and to understand their function in various environments
 - 1. The student will compare the major groups of microorganisms on the basis of structure and examples
 - 2. The student will compare procaryotic and eucaryotic cells on the basis of structure and function
 - 3. The student will discuss and apply methods of observing, staining and culturing microorganisms
 - 4. The student will discuss the effect of microorganisms on the environment
- B. To enable the student to comprehend the sources of microorganisms and various relationships to man and the environment
 - 1. The student will discuss selected historical events and their relationship to microbiology
 - 2. The student will explain the relationship in various ecological situations including normal flora, infection, food poisoning, agricultural effects and biochemical cycles.
- C. To enable the student to understand the basis of infection, disease, control of organisms, and the body's defenses against infection.
 - 1. The student will define concepts of infection and microbial control.

2. The student will discuss the body's non-specific and specific defenses against infection.
3. The student will discuss the relationship between immunity and allergy
- D. To enable the student to understand the importance of metabolism and genetics in microorganisms.
 1. The student will describe concepts of metabolism including enzyme activity.
 2. The student will explain microbial genetics.
 3. The student will be able to explain the role of metabolism and genetics in the control of microorganisms, industry and agriculture

IV. CLASS ACTIVITIES

- A. Lecture
- B. Demonstration
- C. Discussion
- D. Use of microbiological techniques
 1. Use and care of microscope
 2. Staining techniques
 3. Culture media
 4. Isolation of pure cultures of microorganisms
 5. Growth and variation of microorganisms
 6. Identification of unknown bacteria

V. CRITERIA FOR EVALUATION

The student will have demonstrated attainment of the general course competencies if he accumulates a total of 70 percent of the points possible from the following criteria:

- A. Participation in laboratory and class activities
- B. Laboratory Reports/Class Homework
- C. Written examinations
- D. Final examinations