

**Alabama State University  
University College  
Department of Math and Science**

**BIO 127- GENERAL BIOLOGY**

Credit Hrs- 3

**Text Book:** Biology-Inquiry into Life 10<sup>th</sup> Ed. Sylvia Mader

Instructor \_\_\_\_\_ Office Extension \_\_\_\_\_ Office Hours \_\_\_\_\_

**Supporting Services-** Tutoring Services available in **Math & Science Tutorial Center, PH 132.**

**Attendance Policy:** The University's attendance policy will be followed in this course.

*NOTE: Any student requiring alternative formats for testing and/or handouts for this course, or other types of accommodations, due to a handicapping condition, should advise the instructor within the first week of classes.*

**COURSE DESCRIPTION:** This is Part I of a survey course in general biology. The topics covered in this course are: the scientific method, general chemistry, biological molecules, cell structure and function, photosynthesis, cellular respiration, mitosis, meiosis, genetics, and an overview of the taxonomy of the five biological kingdoms with special emphasis on kingdoms Monera and Protista.

**COURSE OBJECTIVES:** The following learning objectives will be addressed in this course. Each topic represents a broad study area in biology.

Objective 1. The study of life (Chapt. 1)

Objective 2. The molecules of cells (Chapt. 2)

Objective 3. Cell Structure and Function (Chapt. 3) and Membrane structure and function (Chapt. 4)

Objective 4. Cellular respiration (Chapt. 7) and Photosynthesis (Chapt. 8)

Objective 5. Cell Division (Chapt. 5)

Objective 6. Patterns of gene inheritance (Chapt. 23) and Patterns of chromosome inheritance (Chapt. 24)

Objective 7. Molecular basis of inheritance (Chapt. 25) and Biotechnology (Chapt. 26)

Objective 8. Microbiology (Chapt. 28) and Plants (Chapt. 29)

Objective 9. Writing exercise(s), quizzes and assignments.

### **EVALUATION AND MINIMUM STANDARDS**

#### **Testing**

During the semester four exams will be given that will evaluate the objectives of the course. The first exam will test objectives 1-2, the mid-term exam will test objectives 3-4, the third exam will test objectives 5-6 and final exam will test objectives 7-8.

#### **Writing Exercise (s)**

To achieve objective 9, (an) acceptable written report(s) must be prepared. The lecture instructor will evaluate the assignment(s).

#### **Tutorial Assistance**

If students do not perform satisfactorily on a test, they should seek help from their instructors or tutors in the Mathematics and Science Center (PH 132).

### Summary of Evaluation Procedure

Test	No. of Questions	Objectives	Points
Test 1	50	1-2	100
Mid-term	50	3-4	100
Test 3	50	5-6	100
Final	50	7-8	100
Writing exercises, quizzes and assignments		9	200
<b>Total Points Possible</b>			<b>600</b>

### Grade Assignments

Grade	Grade Percentile
A	90-100%
B	80-89%
C	70-79%
D	60-69%
F	Below 60%

*All the students with D or F as a Final grade will be required to repeat the course, a university college core course requirement.*

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## DETAILED COURSE OBJECTIVES

### Objective 1. The study of life (Chapt. 1)

Students should be able to:

1. list the levels of organization in order of increasing complexity
2. define and explain the scientific method
3. list steps of the scientific process
4. explain biological diversity
5. define relevance of living organisms and their environment
6. define different branches of biology (appendix 1)

### Vocabulary

Chapt. 1.-Ecosystem, community, population, organism, organ systems, tissue, cell, molecule, hypothesis, controlled and experimental groups.

### Objective 2. The molecules of cells (Chapt. 2)

Students should be able to:

1. define components of atom
2. state the relevance of isotopes in life
3. define electron arrangement of an atom
4. state various bonds in molecules
5. explain the importance of acidic and basic conditions in living organisms
6. explain importance of carbon in molecules
7. define functional groups
8. state the processes by which large molecules are formed
9. name and define carbohydrates
10. explain lipids and their uses in living systems

11. list the amino acids and how they are converted into proteins

### **Vocabulary**

Chapt. 2-Compound, atom, protons, electrons, neutrons, atomic number, atomic weight, radioactive isotopes, electron shells, chemical bonds, ion, ionic bond, covalent bond, nonpolar, polar molecule, cohesion, surface tension, solution, solute, solvent, acid, base, buffers, organic compound, hydrocarbons, hydrophilic, hydroxyl group, carbonyl group, amino group, polymers, monomers, monosaccharides, polysaccharides, hydrophobic, protein, peptide bond.

**Objective 3.** Cell structure and function (Chapt. 3) and Membrane structure and function (Chapt. 4)

Students should be able to:

1. explain principle of microscopy
2. state prokaryotic and eukaryotic cells
3. list and define cell organelles
4. state basic functions of cell components
5. define functions of eukaryotic organelles
6. enumerate and explain laws of thermodynamics
7. explain mechanism of energy coupling
8. describe the enzymes, their mechanisms and types inhibitors
9. state cellular membranes and its constituents
10. explain passive and active transports

### **Vocabulary**

Chapt. 3 and 4-Magnification, resolving power, cell theory, prokaryotic and eukaryotic cells. fluid mosaic, signal transduction, diffusion, passive transport, concentration gradient, osmosis, hypertonic, hypotonic, isotonic, active transport, exocytosis, endocytosis, phagocytosis, pinocytosis, receptor-mediated endocytosis.

**Objective 4.** Cellular respiration (Chapt. 7) and Photosynthesis (Chapt. 8)

Student should be able to:

1. state aerobic and anaerobic respiration
2. explain the role ATP in cellular activities
3. define electron transport chain
4. state mechanisms of ATP production
5. enumerate steps involved in glycolysis, krebs cycle, and chemiosmosis
6. explain anaerobic respiration
7. define autotrophs and heterotrophs
8. list the components of chloroplast and their role in photosynthesis
9. name the stages and mechanisms of photosynthesis
10. explain how ATP, O<sub>2</sub> and NADPH are generated
11. state process of photophosphorylation
12. define Calvin cycle

### **Vocabulary**

Chapt. 7-Oxidation, reduction, electron transport chains, chemiosmosis, glycolysis, krebs cycle.  
Chapt. 8- Photosynthesis, autotrophs, producers, thylakoids, grana, light reaction, carbon fixation, photon, reaction center, photosystem, photophosphorylation, photorespiration, C<sub>3</sub>/C<sub>4</sub> plants.

**Objective 5.** Cell division (Chapt. 5)

Students should be able to:

1. define binary fission
2. state cell cycle
3. explain the process of cell division
4. name the stages of mitosis
5. distinguish cytokinesis between animal and plant cells
6. state functions of mitosis in living organisms
7. explain how gametes are formed
8. explain the process of meiosis
9. compare mitosis and meiosis
10. discuss the process of sexual reproduction
11. explain genetic variability

**Vocabulary**

Chapt. 5.-Sexual/asexual reproduction, binary fission, chromatin, somatic cells, sister chromatids, centromere, cell cycle, mitosis, mitotic spindle,

**Objective 6.** Patterns of gene inheritance (Chapt. 23) and Patterns of chromosome inheritance (Chapt. 24)

Students should be able to:

1. describe concepts of Mendelian genetics
2. explain laws of segregation and independent assortment
3. state Mendelian principles in inheritance human traits
4. define incomplete dominance
5. exemplify forms of gene
6. define pleiotropy, polygenic, and chromosomal theory of inheritance
7. discuss linked genes and crossing over
8. enumerate sex chromosomes and its pattern of inheritance
9. define nucleotides
10. describe DNA as double helical molecule
11. explain the process of DNA replication, transcription and translation
12. discuss genetic materials of viruses and their mode of replication

**Vocabulary**

Chapt. 23.-Self/cross fertilization, hybrids, dominant/recessive alleles, homozygous, heterozygous, phenotype, genotype, test cross, incomplete dominance, codominance, pleiotropy, genetic disorders.

Chapt. 24.-Karyotype, Chromosomal diseases, Deletion, duplication, translocation, inversion, sex-linked trait.

**Objective 7.** Molecular basis of inheritance (Chapt. 25) and Biotechnology (Chapt. 26)

Students should be able to:

1. explain structure and function of nucleotides
2. describe how genes are turned on and off
3. explain bacterial operon
4. state gene expression
5. exemplify signal transduction
6. define recombinant DNA

7. explain transformation
8. state RFLPs, PCR, DNA and fingerprinting
9. illustrate significance of DNA technology in human health, and agriculture

### **Vocabulary**

Chapt. 25 Nucleotides, DNA replication, gene expression, promoter, operator, repressor, activators, introns, exons, RNA splicing.

Chapt. 26.-Transformation, conjugation, plasmid, vector, restriction enzyme, DNA ligase, RFLP, DNA fingerprinting, transgenic organism.

### **Objective 8.** Microbiology (Chapt. 28) and Plants (Chapt. 29)

Students should be able to:

1. describe basic principles of systematics
2. explain phylogenetic lineage
3. name kingdoms of classification scheme
4. describe evidences of origin of life
5. state prokaryotic evolution
6. describe different groups of bacteria and their properties
7. list protists and their salient features

### **Vocabulary**

Chapt. 28.-Monera, cocci, bacillus, spirillum, heterotrophs, autotrophs, pathogens, exotoxins, endotoxins, lyme disease, plasmodium, fungi, dinoflagellates, diatoms, green algae.

Chapt. 29.- Mycorrhiza ; sporangia ; bryophytes ; seeds, pollen, gymnosperm, angiosperm; fungi, hyphae, mycelium ; dikaryotic phase ;

### **Objective 9.** Writing exercise(s), quizzes and assignments.

Individual instructor will determine format, frequency, and scoring of writing exercise(s), quizzes and assignments.

**GENERAL BIOLOGY LABORATORY (BIO 127) \_\_\_\_\_ Credit Hour - 01**  
**Fall/Spring Semester**

**Laboratory Manual: Exploring Biology in the Laboratory**

*Shree R. Singh & Karyn D. Scissum Gunn*

Lab Section \_\_\_\_\_ Lab Hour & Day \_\_\_\_\_ Lab Room-SB 203  
Instructor \_\_\_\_\_ Office Extension \_\_\_\_\_ Office Hours \_\_\_\_\_

**Supporting Services-** Tutoring/Audio-Visuals/Computer software  
Math & Science Tutorial Center, PH 132 (8:00 a.m.-5:00 p.m., M-F)

**Attendance Policy:** Each student is expected to attend all lectures, seminars, laboratories and field work for each registered course, including the first class session. Attendance is required to verify official enrollment and continuance in each course. When students are absent from class for authorized reasons such as death in the family, illness, hindrance by true emergency situations or University activities, they will be allowed to make up assignments/ examinations that they missed. Instructors, of course, are not obligated to provide makeup opportunities for students who are absent, unless the absences have been officially approved. Official excuses can be obtained from the Office of Student Affairs.

*NOTE: Any student requiring alternative formats for testing and/or handouts for this course, or other types of accommodations, due to a handicapping condition, should advise the instructor within the first week of classes.*

**Course Description:**

This general biology laboratory course is designed to correspond with the first part of the introductory biology. This course is contrived to expose students with the basic principles and theories of biology. Each laboratory exercise provides ample hands-on experience based on every day observations in life. This laboratory course will enable students to be familiar with biological instruments, chemicals, solutions, experimentation and some current techniques. The laboratory exercises range from the study of microscopes, plant and animal cells, mitosis, meiosis, and photosynthesis to recombinant DNA techniques.

**Course Goals:**

To provide students with the opportunity to receive “hands-on” experience with scientific techniques and methods, so that the student will be able to relate the information gained in this course to everyday life situations. This course has following major objectives:

1. To introduce and familiarize students with basic biological phenomena
2. To provide students an opportunity to be actively involved in carrying out an experiment
3. To encourage students to design their own ideas and experimentation based on biological principles
4. To develop the student’s skill in writing, reading, analytical thinking, problem solving, graphics and mathematical calculations.

To meet the above goals, this course will focus on the following **objectives**. Each objective is diverse and covers different activities as described in detail description of the course.

Objective*	Corresponding Labs in the Manual
1 Scientific Inquiry	Laboratory 1
2 Measurement and Chemical Solutions	Laboratory 2
3 Microscopy	Laboratory 3
4 DNA: The Genetic Material	Laboratory 4
5 Cell Structure and Function	Laboratory 5
6 Diffusion and Osmosis	Laboratory 6
7 Photosynthesis and Plant Structure	Laboratory 7, Laboratory 13, and Laboratory 14
8 Mitosis & Meiosis	Laboratory 8
9 Mendelian and Human Genetics	Laboratory 9

10	Molecular Biology Recombinant DNA Technology	Laboratory 10
11	Monera and Protista	Laboratory 11
12	Laboratory Assignments (See Page 7)	Laboratory 12

\*Laboratory experiments may vary depending on the availability of instruments and supplies.

### EVALUATION AND MINIMUM STANDARDS

Testing: During this laboratory course, students will be tested from each objective. **The midterm and final exams will be comprehensive.**

**Number of Tests:** There will be a total of four tests including midterm and final. Instructors may give additional quizzes during the semester.

**Composition of Tests:** Test items on the test may be multiple-choice (MC), fill in the blanks (FB), matching (MT), completion (CP), and calculations (CAL). Midterm and final exams will contain practical lab questions inclusive of identification (PR). The instructors will determine the number of these questions. Each objective will be weighed equally in terms of testing. Students will be tested on the terms discussed in each objective.

**Minimum Standard for Passing:** To pass an objective, students must obtain 70% of the points for each objective. To pass the lab, students have to score a total of **350 points and pass 9/12 objectives**. Students must pass **objective 12** to pass the course.

#### Testing Table

Test	No. of Questions	Points
Test 1	50	100
Mid-term	50	100
Test 3	50	100
Lab Assignments		100
Final	50	100
<b>Total</b>		<b>500</b>

#### Grading Table

Grade	Range of total points	No. of Objectives to be passed
A	450-500	11
B	400-449	10
C	350-399	9
D	300-349	8
F	Below 300	Below 8

All the students with D or F as a Final grade will be required to repeat the course, a university college core course requirement.

#### LABORATORY POLICIES

All students are expected to arrive for class ON TIME and leave ONLY after the work is completed. A student may not be allowed to attend the lab if he/she arrives late. You must abide by the University's attendance policy. All students are expected to read each exercise before coming to class. This includes the introduction, procedures and all the terminology in bold face. You may be tested on these exercises. The students should read and follow the instructions in the lab manual while performing the experiment. Attending one of the labs that meets during the week the lab experiment was missed can make up lab experiments. Examinations can be made up **only at the end of semester (last week of labs)**, if an official excuse is presented. Unexcused absences from any examination or laboratory will count as zero.

#### LISTED BELOW ARE A FEW RULES TO FOLLOW IN YOUR LABORATORY WORK:

1. Read and follow directions given in your lab manual.
2. Handle all equipment with care.

3. Leave equipment, slides or preserved materials on the lab tables neatly arranged.
4. Discard materials as directed.
5. Do not remove solutions or other materials from demonstration table.
6. Always handle all the chemicals with care.
7. Always empty and rinse all glassware used and return it to your work place.
8. Beepers and telephones are not allowed in the lab.
9. Dress properly (No Hats).
10. There will be a severe disciplinary action if any student is caught while cheating during the test.

## Detailed Course Objective

The following laboratory exercises are designed to meet the objective of this course. Each objective contains variety of reading/writing exercises, mathematical calculations and scientific reasoning.

### **Objective 1. Scientific Inquiry (Laboratory 1)**

Students should be able to:

1. formulate and test hypotheses
2. design an experiment to answer questions

**Terms to define:** Theory, induction, deduction, hypothesis, variables, graphs.

### **Experiments: Toilet Paper Strength Exercise**

**Lab Assignment:** Lab 1. Scientific Inquiry

### **Objectives 2 & 3. Measurements and Microscopy (Laboratory 2 & 3)**

Students should be able to:

1. recognize graduated cylinders, beakers, flasks, pipets, and test tubes
2. explain the concepts of measurements such as length, volume and mass
3. describe different measurement systems
4. convert units from one system to another
5. describe how to care for a microscope
6. recognize the parts of compound microscope and know their functions
7. define the principles of microscopy

**Terms to define:** Qualitative and quantitative observation, gram, meter, liter, degree Celsius ( $^{\circ}\text{C}$ ), Fahrenheit ( $^{\circ}\text{F}$ ), kilogram.

**Equipment to identify:** beaker, graduated cylinder, pipet, Erlenmeyer flask, balances, thermometers, and some other commonly used equipment.

### **Experiments:**

I.	Length	Lab 2.1
II.	Mass	Lab 2.2
III.	Volume	Lab 2.3
IV.	Temperature	Lab 2.4
V.	TEST FOR STARCH, PROTEIN & GLUCOSE	Lab 2.7

**Lab Assignment:** Lab 2. Measurements and Chemical Solutions

### **Microscopy (Laboratory 3)**

**Terms to define:** Magnification, resolution, contrast, parfocal, parcentral, working distance

**Equipment to know:** Compound light microscope, dissecting microscope, know all the parts of the light microscope and their function.

**Video tape:** Using the compound Microscope

**Experiments:**

- I. The compound light microscope
  - A. Proper handling and care of microscopes Lab 3.1
  - B. Parts of the Compound Light Microscope Lab 3.2
  - C. How to use a microscope to observe a specimen Lab 3.2
  - D. Measurement of the field of view Lab 3.4

**Objective 4. DNA: The Genetic Material (Laboratory 8)**

Students should be able to:

1. describe the components of DNA
2. distinguish between DNA and RNA
3. demonstrate the structure of DNA and RNA
4. read codons

**Terms to define:** DNA, RNA, replication, transcription, translation, purine, pyrimidine, codon, peptide bond, and amino acids.

**Objective 5. Cell Structure and Functions (Laboratory 4)**

Students should be able to:

1. recognize different parts of the cell
2. differentiate between plant and animal cell
3. make plant and animal cell slides
4. state the function of different cellular components
5. state the properties of prokaryotic and eukaryotic cells

**Terms to define:** Cell, cell theory, prokaryotes, eukaryotes etc.

**Objective 6. Diffusion and Osmosis (Laboratory 5)**

Students should be able to:

1. explain the significance of the concentration gradient
2. describe the significance of the selectively permeable membrane
3. distinguish between osmosis and diffusion
4. state the role of varying osmotic concentrations

**Terms to define:** Osmosis, diffusion, solvent, solute, tonicity, hypotonic, hypertonic, isotonic and selectively permeable membrane.

**Experiments:**

- A. Diffusion of methylene blue and potassium
- B. Osmosis with dialysis tubing
- C. Demonstration of tonicity using raisins

**Objective 7. Photosynthesis (Laboratory 6)**

Students should be able to:

1. state the role of CO<sub>2</sub> and light in photosynthesis
2. explain the importance of colors based on their wavelength

3. identify the pigments found in the green leaf
4. explain the different plant cell structures involved in photosynthesis
5. describe the characteristics of vascular plants
6. understand the function of vascular plants
7. recognize the structure of flowering plants

**Terms to define:** Photosynthesis, autotrophs, heterotrophs, chromatogram, stroma, grana, thylakoid disk, seedless plants, gymnosperm, angiosperm, bryophytes, cones, seeds.

**Experiments:**

- A. Floating Leaf Disk Assay
- B. Paper Chromatography
- C. Examination of leaf structure

**Objective 8. Mitosis and Meiosis ( Laboratory 7)**

Students should be able to:

1. state the stages of cell division
2. distinguish between cytokinesis and mitosis
3. recognize the changes in chromosome structure during mitosis and meiosis
4. differentiate between plant and animal cytokinesis
5. identify the similarities and differences between mitosis and meiosis
6. illustrate the gamete constitution of body cells and sex cells
7. describe the genetic process of egg and sperm formation

**Terms to define:** Cell cycle, mitosis, prophase, metaphase, anaphase, telophase, cytokinesis, DNA replication, chromatid, spindle apparatus, fertilization, zygote, sperm, egg, meiosis, homologue, diploid, haploid, allele, gamete etc.

**Video Tape:** Cell division

**Experiments:**

- |      |                                 |         |
|------|---------------------------------|---------|
| I.   | The Cell cycle                  | Lab 7.1 |
| II.  | Observing Onion root tip slides | Lab 7.2 |
| III. | Observing mitosis models        | Lab 7.3 |
| IV.  | Observing Gametogenesis models  | Lab 7.5 |

**Lab Assignment:** Lab 7. Mitosis and Meiosis  
Sketches of Cell Cycle

**Objective 9. Mendelian and Human Genetics (Laboratory 9)**

Students should be able to:

1. solve monohybrid problems
2. solve dihybrid problems
3. describe the inheritance of characteristics generation to generation
4. determine the phenotype of an individual based on the genotype
5. define genetic abnormality and disorder

**Terms to define:** Genetics, dominance, recessive, complete dominance, incomplete dominance, true breeding, gamete, allele, homozygous, heterozygous, monohybrid cross, dihybrid cross, sex-linked traits, multiple alleles, phenotype, genotype, Punnett square

**Experiments:**

- |      |                                 |         |
|------|---------------------------------|---------|
| I.   | The Monohybrid Cross            | Lab 9.1 |
| II.  | The Dihybrid Cross              | Lab 9.2 |
| III. | Exceptions to the Mendel's Laws | Lab 9.3 |

- IV. Genetic Abnormalities
- V. Karyotype Analysis

**Lab Assignment:** Lab 9. Mendelian Genetics

**Objective 10. Molecular Biology and Recombination of DNA (Laboratory 10 and 11)**

Students should be able to:

1. state the definitions of plasmids
2. understand how modern technology influences the current understanding of research

**Terms to define:** genetic engineering, autosomal dominant inheritance, mutation, DNA ligase, and deletion.

**Lab Assignment:** Lab 10 and 11

**Objective 11. Taxonomy-Monerans and Protistans (Laboratory 12)**

Students should be able to:

1. distinguish common names from scientific names
2. illustrate the importance of scientific names in biology
3. identify the genus and specific epithet in scientific name
4. identify and classify different bacterial species and protozoans
5. define the different forms of bacterial shapes
6. understand the economic relevance of monerans and protistans

**Terms to define:** common name, scientific name, binomial nomenclature, genus, specific epithet, decomposer, producer, consumer, gram stain, antibiotic, cilia, flagella, pseudopodia, micronuclei, and macronucleus.

**Experiments:**

- |                      |          |
|----------------------|----------|
| I. Kingdom Monera    | Lab 12.1 |
| II. Kingdom Protista | Lab 12.2 |

**Lab Assignment:** Lab 12.

**Objective 12. Writing Exercises**

Writing exercise(s), quizzes, and assignments.

Individual instructor will determine format, frequency, and scoring of writing exercise(s), quizzes and assignments.

At the end of each laboratory there are lab assignments. These lab assignments are to be completed after your instructor has taught the lab. You will be graded on the assignment that will contribute to a total of 100 points. You must answer 70% of the questions correctly to pass an assignment. Your instructor will determine the number of lab assignments. Following are some of the ways that can be used by your instructor to grade the lab assignments:

You may be required to turn in Ten (10) assignments each worth 10 points

OR

You may be required to turn in Five (5) selective lab assignments each worth 20 points

In order to pass this objective, you must earn 70 points